MOORE®
Process Automation Solutions

USER'S MANUAL

UM760D-1
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Series 760D ValvePAC™ Digital Valve Controller

Intelligent Valve Control

Our Positioners Control the Best Valves & Actuators in the World

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Changes for September 1999 printing

Cover and page dates were not changed at this time.

Section	**Change**
1.2	Product support information updated.

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1.0 INTRODUCTION

This User's Manual for the Moore ValvePAC ValvePAC Valve Controller (ValvePAC), is divided into the following sections:

Introduction—Contains product description, product support and related literature.

Principles of Operation—This section is for the first-time user of the ValvePAC. Any user unfamiliar with the ValvePAC should read this section before attempting to install, configure, or operate the unit.

Installation—Provides product dimensions, general installation considerations, and installation procedures.

Operation—Defines the controls and signal displays.

Trouble Shooting—Offers procedures and options to confirm setup and configuration.

Maintenance—Furnishes preventive maintenance guidelines. A Parts List is at the end of this section.

Model Designation—Provides model designation.

Specifications—Consists of mechanical, electrical, and environmental specifications.

Parts List—Provides parts drawing and parts list.

1.1 PRODUCT DESCRIPTION

This manual describes the procedures for configuring, calibrating, and operating the Moore ValvePAC ValvePAC Valve Controller. An optional, companion software product, ValVue™, can be used to configure, calibrate, and perform valve diagnostics on the ValvePAC from a remote Windows 95-based Personal Computer.

The ValvePAC is a single or double-acting valve controller that accepts a 4-20 mA input signal and converts it to a pneumatic output to position a control valve actuator. The controllers can be used with either rectilinear or rotary, single or double acting actuators. Rectilinear action can range from 1/2" to 6" in valve stroke. Rotary action can range from 45 to 110 degrees. A spool valve is used to load the actuator for positioning in response to an input signal.

The ValvePAC can be configured, calibrated, and operated locally or remotely. Local functions are controlled by means of local pushbuttons and digital display. Remote operation requires the use of ValVue, or a HART® communicator.

As an option, the ValvePAC can also be configured to include a process controller. The process controller accepts standard inputs for process variable and setpoint, and provides an output signal to the valve controller's function to achieve the value desired for the process variable.

ValVue, the optional software for remote control of the ValvePAC, runs on standard IBM-compatible computers with 486 or Pentium processors. Minimum requirements are 8 MB RAM, Windows 95, one available serial port with a HART modem, and a hard disk drive. The basic functions performed by ValVue are:

- Display of valve position, actuator pressure, setpoint, calibration parameters, configuration parameters, and status/error indicators
- Calibration
- Configuration
- Operation
- Manual control of valve position
- Perform valve diagnostics and display results (signature, friction, stroking speed, cumulative travel, cycles, and operation in near-closed position)
- Recall previous test results for comparison with current data

These remote functions, except for extended diagnostics, can also be performed with a hand-held unit.

1.1.1 ValvePAC FEATURES AND FUNCTIONS

- Local operation, calibration, and configuration using optional pushbuttons and digital display
- Remote operation, calibration, and configuration diagnostics using ValVue software or a hand-held HART communicator with Device Descriptor (DD)
- Two-way data communication using industry-standard HART protocol
- Automatic setup of valve travel range (can be user-modified)
- User-configurable tight shutoff adjustment
- Optional PID controller with remote setpoint and process variable inputs
- User-adjustable response times
- Direct or reverse acting operation
- Compatible with air-to-close or air-to-open actuators
- Span and zero configurable for split-range operation
- Local operation functions include:
  - Calibrate valve stroke range, tight shutoff point, position limits
  - Display and/or set parameters for valve configuration
  - Operate valve in manual mode or 4-20 mA mode
  - Select characterization (linear, equal percentage 50, equal percentage 30, quick opening, or custom)
  - Display/clear fault codes
  - Display valve position
  - Display faults
- Remote operation functions include all of the above, plus the following, when running the optional ValVue™ software on a PC:
  - Display total stem travel, number of valve cycles and other data useful for predicting valve life
  - Run valve diagnostics

1.2 PRODUCT SUPPORT

Product support can be obtained from a Technical Information Center (TIC). Each regional TIC is a customer service center that provides direct telephone support on technical issues related to the functionality, application, and integration of all products supplied by Moore. Regional TIC contact information is provided in the following table. Your regional TIC is the first place you should call when seeking product support information. When calling, it is helpful to have the following information ready:

- Caller ID number, or name and company name - When someone calls for support for the first time, a personal caller number is assigned. Having the number available when calling for support will allow the TIC representative taking the call to use the central customer database to quickly identify the caller's location and past support needs.
- Product part number or model number and version
- If there is a problem with product operation:
  - Whether or not the problem is intermittent
  - The steps performed before the problem occurred
  - Any error messages or LED indications displayed
  - Installation environment

Customers that have a service agreement (ServiceSuite or Field Service Agreement) are granted access to the secure area of our Web site (**www.moore-solutions.com/techservices**). This area contains a variety of product support information. To log on, you will be prompted to enter your *username* and *password*.

TIC CONTACT INFORMATION

TIC NORTH AMERICA	Tel:	+1 215 646 7400, extension 4842
	Fax:	+1 215 283 6343
	E-Mail:	TICGroupNA@moore-solutions.com
	Hours of Operation:	8 a.m. to 6 p.m. eastern time Monday – Friday (except holidays)
	Secure Web Site:	www. moore-solutions.com/techservices

TIC ASIA	Tel:	+65 299 6051
	Fax:	+65 299 6053
	E-Mail:	TICGroupAP@moore-solutions.com
	Hours of Operation	9 a.m. to 6 p.m. Singapore time Monday – Friday (except holidays)
	Secure Web Site:	www.moore-solutions.com/techservices

TIC EUROPE	Tel:	+44 1935 470172
	Fax:	+44 1935 706969
	E-Mail:	TICGroupEurope@moore-solutions.com
	Hours of Operation	8:30 a.m. to 5:15 p.m. GMT/BST Monday – Friday (except holidays)
	Secure Web Site:	www.moore-solutions.com/techservices

1.3 RELATED LITERATURE

When the ValvePAC is furnished with the optional software, the following Software Guide should be available when configuring the ValvePAC.

- ValVue Configuration Software for the ValvePAC ValvePAC Digital Valve Controller (SG15939-76)

2.0 PRINCIPLES OF OPERATION

When configured as an electro-pneumatic valve controller, the ValvePAC unit accepts a 4-20 mA setpoint signal from a controller or other device. After adjusting for zero and span, it compares this input signal to the actual valve position, which it measures with the potentiometer that is connected to the feedback shaft. The difference between the setpoint and the actual position is then amplified and a corrective current signal is sent to the electro-pneumatic converter (EPC). The EPC converts the current signal to a pneumatic signal, which is sent to the pneumatic relay and the spool valve. The spool valve directs supply air to the actuator to move the valve until the potentiometer reading agrees with the setpoint.

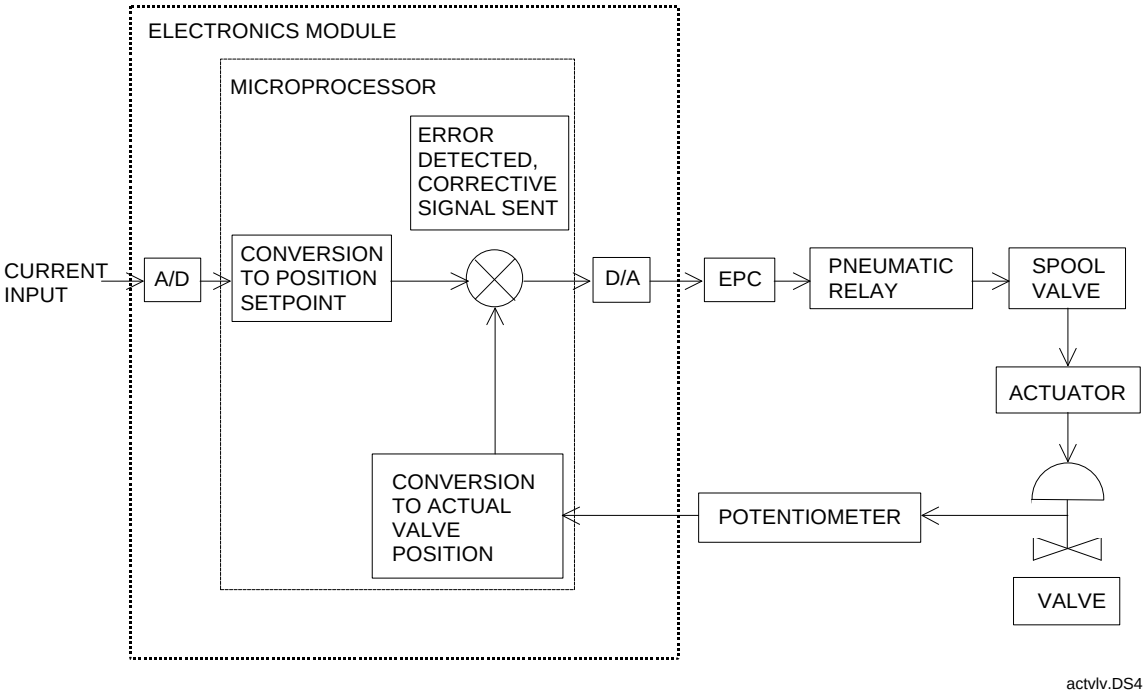


FIGURE 2-1 Block Diagram of ValvePAC Unit, Actuator, and Valve

2.1 BIAS

A good understanding of the ValvePAC requires a good understanding of bias. The bias is the current signal that the ValvePAC's internal circuitry must send to the EPC (the I/P transducer) in order to hold the spool valve in a steady state position, where the actuator neither fills nor exhausts.

One of the most important steps in the calibration process is the adjustment of the "bias spring." There is a limit to how much the current signal to the EPC can vary. (The optional ValVue software displays this current as a value between 0 and 5500.) This means that there is a limit to how much the EPC's output pressure can rise or fall. When adjusting the spring, the goal is to set the force such that the EPC's output can rise and fall enough to move the spool up and down properly during step changes. With such a restriction on the range of the current signal to the EPC, there must be a limit to how far the neutral current, or bias can be allowed to vary. A value between 2250 and 3500 will yield successful results.

To maintain valve position, the ValvePAC constantly updates the bias as conditions (e.g. temperature, orientation) warrant. In consideration of this fact, the factory sets the bias near 2750. Occasions may arise where further adjustment is necessary. In such a case, the bias spring should be adjusted so either more or less pressure is required by the EPC to balance the system.

2.2 SETPOINT

As a field connection applied at two screw terminals in the terminal compartment, the setpoint provides an analog input of 4 to 20 mA (in analog mode) or 12 to 25 volts (in multi-drop, digital mode).

The setpoint input establishes setpoints for the following:

- Valve when operating as a positioner
- Control loop when operating as a single loop process controller

The setpoint input also provides power to operate the instrument.

The control setpoint terminals, in either analog or digital operating modes, provide a HART protocol-compliant communication signal. In the analog mode, the HART signal is superimposed on the 4 to 20 mA control signal. The control setpoint terminals also support HART burst, analog, and multi-drop non-analog modes.

NOTE

All electrical connections are isolated from the housing.

Figure 2-2 illustrates the setpoint operation and the relevant positions of the electronic module, spool valve, actuator, valve, and feedback potentiometer.

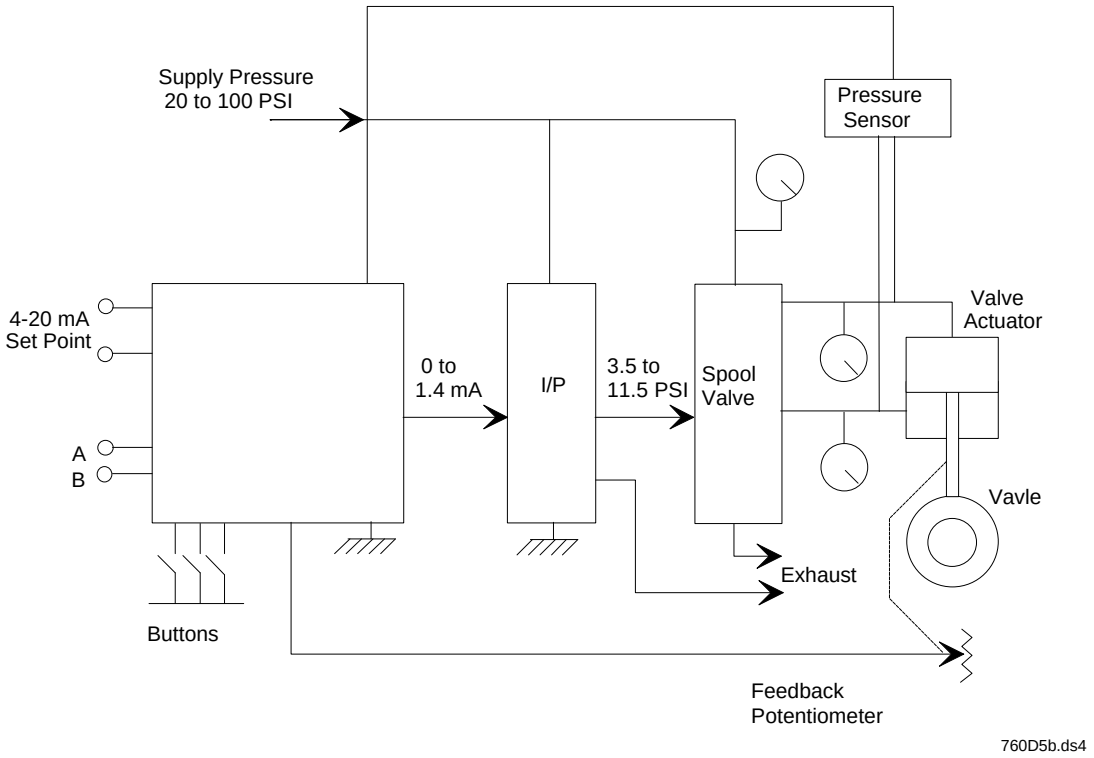


FIGURE 2-2 Setpoint Operation

2.3 PUSHBUTTONS

The ValvePAC housing may contain three optional pushbutton switches and a local display. These features permit reading and modification of the instrument operating parameters without a PC or HART hand-held communicator. The buttons perform "generic" functions (Increase, Decrease, and Accept) and facilitate movement through a conventional menu structure (see section 4.0, Operations).

2.4 FEEDBACK POTENTIOMETER

Because of its mechanical linkage to the valve stem, the feedback potentiometer position corresponds directly to the valve stem position. The feedback potentiometer is mounted inside the ValvePAC housing. Its function depends on the method of configuration.

As a positioner or controller, the feedback potentiometer provides feedback to the position control algorithm. As a transducer (EPC), the feedback potentiometer signal can communicate valve position using the HART protocol.

2.5 AUTOTUNE

The AutoTune procedure automatically determines position control parameters, such as P, Padj, I, D, and dead zone. The AutoTune procedure includes three steps:

- Search for bias
- Estimate control parameters
- Refine control parameters

In searching for the bias, the ValvePAC locally displays values (such as 2753 and 2761) that approach, or converge on, a real bias value. Expect the valve to move back and forth, slow down, and remain still by the end of this step.

In estimating control parameters, ValvePAC displays three types of values: input step sizes (such as 80 and 320), valve relative opening (such as 1874 and 1756), and dead time (such as 4.00 and 7.00). Expect the valve to move back and forth several times. ValvePAC uses these tests to estimate the preliminary control parameters based on position control characteristics.

In refining the estimated control parameters, ValvePAC displays several numbers (such as 1211 and 6). Interpret the number 1211 as the rising time (T98 is 12 x 0.05ms = 0.6 ms) and overshoot is 11%. The code number 6 indicates a specific control parameter adjustment.

A successful AutoTune provides position step responses, in both air fill and exhausting directions, that meet the tuning criteria. Overshoots range between 0 and 8%, and rising times range from 0.5 second for a small actuator to 1.5 second for a large actuator. A successful AutoTune updates the previous control parameters.

AutoTune usually results in fast position responses (0 to 8% overshoots). If the user prefers a smooth response without overshoots, reduce the P value by 10 to 20%. If the user prefers a slow response, set the damping coefficient at 1 to 9 (e.g., zero equals no damping, 9 equals maximum damping)

2.6 PROCESS DESCRIPTION

Cold Reset

The following steps reflect the process of signal generation and the sequence of starting the ValvePAC:

NOTE

This sequence resembles the steps in starting a PC for the first time and is considered a typical “cold reset” sequence.

1. Sensors provide a signal to the A/D converter, which sends the signal to the microprocessor.

2. The microprocessor supplies the display and pushbutton interface, and outputs the signal to the D/A converter and to the EPC.
3. Air feeds into the EPC to the spool valve and then to the actuator.

4. When power is applied to the ValvePAC, the microprocessor searches stored memory and loads the appropriate configuration and startup information into the microprocessor. This is the only time when the ValvePAC goes back and reads the stored memory.

5. The ValvePAC displays the Reset message for a few seconds.

Hot Reset

A "hot reset" results from performing a reset from the optional ValVue software. The system does not re-load all information in the stored memory into the microprocessor.

2.7 PROCESS CONTROLLER OPTION

The ValvePAC can be purchased with an onboard single loop PID controller. When this option is installed and turned on, the secondary input terminals (marked A and B) become active. The process variable feedback signal is measured across these terminals, typically as 1-5 volts. You may choose to range this input. The primary input signal (measured across the + and - terminals) is used as the controller setpoint and must be between 4 and 20 mA to power the unit.

NOTE

The system does not isolate the process input from the control input. Take suitable precautions to avoid ground loops.

2.7.1 Configuration without Process Feedback

Configuration without process feedback, the simplest configuration for the controller, requires two two-wire lines to the field. The sense resistor is located across the auxiliary terminals of the ValvePAC. No sensing of the controlled variable exists in the control room. In a heat exchanger with a primary variable of temperature and a secondary variable of flow, for example, the ValvePAC functions as the flow controller. The operator can adjust flow based on the requirements of the temperature loop, with no need to monitor flow from the control room. For an example of this configuration, refer to Figure 3-8.

2.7.2 Configuration with Process Feedback

Configuration with process feedback uses three two-wire connections to the field. The control room senses the controlled variable as a 1-5 volt signal. For an example of this configuration, refer to Figure 3-10.

2.7.3 Intrinsically Safe System

An intrinsically safe configuration develops the 1-5 volt process signal in the MTL 788R+ barrier (user supplied) and returns it to the ValvePAC as a voltage signal. The 728+ barrier supplies the ValvePAC with the 4-20 mA signal.

This configuration requires special certification (approved by the local jurisdiction). It connects two IS loops together in one instrument, a configuration not generally allowed. Note that in each configuration, the negative input to the ValvePAC, and the B input, remain at the same potential except for wiring drops. For an example of this configuration, refer to Figure 3-9.

■

3.0 INSTALLATION

If the controller is to be stocked, stored, or shipped to another location prior to piping, make sure that the factory installed plastic plugs remain in the pneumatic ports to prevent entry of moisture, dirt, or other contaminants.

Operating limits are stated in section 8.0, Specifications, of this document. The temperature in the selected location must not exceed the specified operating temperatures.

CAUTION

Exceeding the specified operating temperature limits can adversely affect performance and safety, and may cause damage to the Controller.

The Controller will need to be calibrated before being put into service.

3.1 MOUNTING ON THE ACTUATOR

Refer to Figure 3-1 for dimensions and mounting hole locations. The ValvePAC can be mounted in any orientation, but the mounting must be rigid for optimal performance.

1. Determine the orientation of the unit. If the ValvePAC is to be mounted on a rotary actuator see section 3.1.1, Rotary Actuator. If the ValvePAC is to be mounted on a rising stem actuator see section 3.1.2, Rising Stem Actuator.

2. Position the ValvePAC on the actuator mounting bracket and secure in place with four M6 x 1 bolts.

3. Install the pneumatic piping.

4. Install the electronic connections

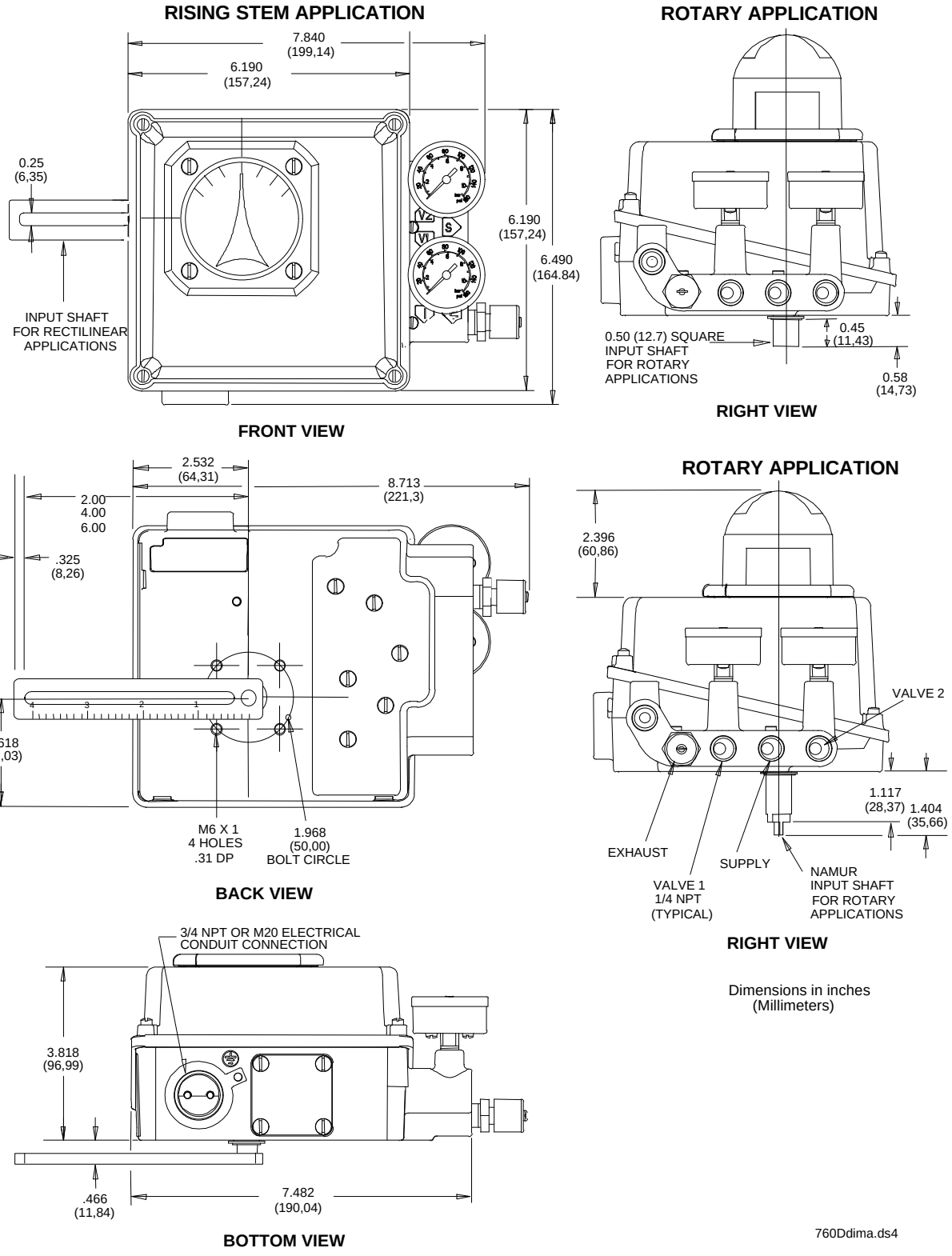


FIGURE 3-1 Installation Dimensions

3.1.1 Rotary Actuator

Couple the specified rotary input shaft to the actuator shaft. Shaft centerlines must be in-line to minimize friction and binding as shafts rotate.

3.1.2 Rising Stem Actuator

When the actuator is at mid-stroke, the feedback lever must be perpendicular to the actuator stem.

The connection between the actuator stem and the feedback lever is typically made using a slotted bracket and a feedback pin. The bracket is attached to the stem and must be rigid so that motion is transferred to the pin without deflection.

There are two ways to transfer the motion through the pin. The recommended method is illustrated in Details A and B of Figure 3-2. Here, the pin is fixed in the slotted bracket and rides inside the feedback arm. For optimal linearity, the distance between the centerline of the ValvePAC's shaft and the centerline of the pin at mid-stroke must equal: *0.866 x the actuator stroke*.

The alternate assembly method is to fix the pin in the feedback lever and have it ride freely inside the slotted bracket. This is illustrated by Detail C. In the case, the distance between the centerline of the ValvePAC's shaft and the centerline of the pin must be: *1.0 x the actuator stroke*. This arrangement will increase the linearity error to approximately 2%.

Retaining Clip Installation

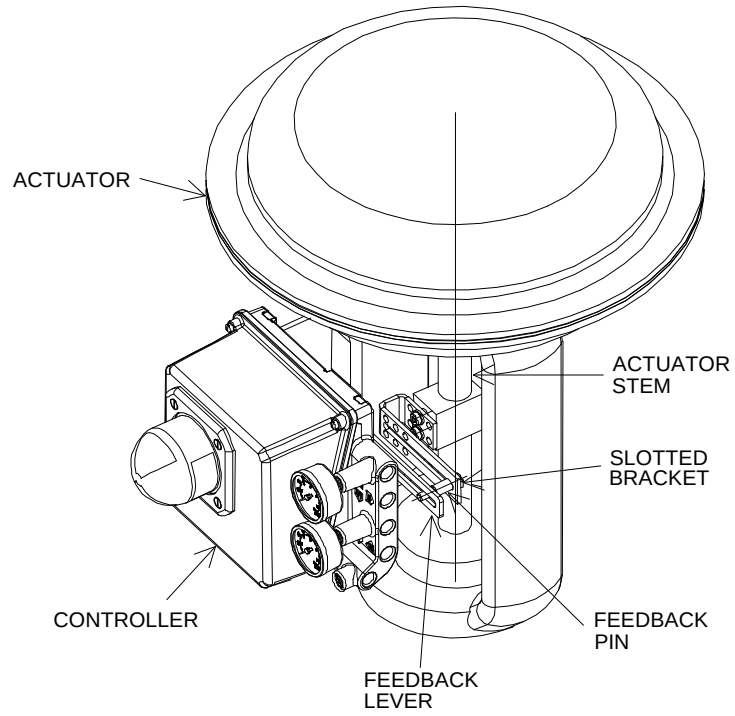
The retaining clip is used with rising stem actuators to hold the feedback pin securely against one side of the feedback lever's slot. This prevents excessive play in the linkage and limits the amount of error introduced into the system through the linkage.

The clip may be installed in any one of the four orientations shown in Figure 3-3.

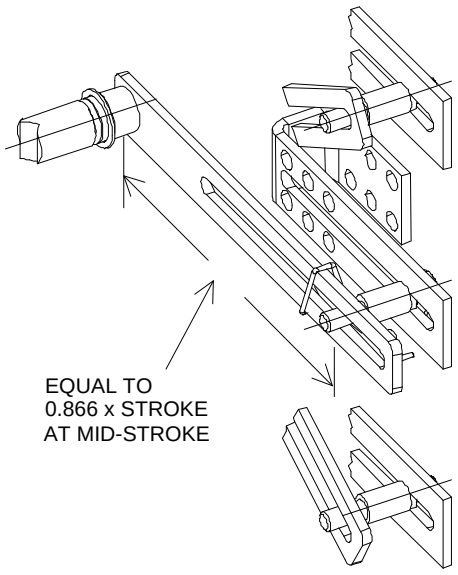
IMPORTANT

> The clip must be positioned such that the pin sits in the innermost side of the clip's slide area when the actuator is at mid-stroke.

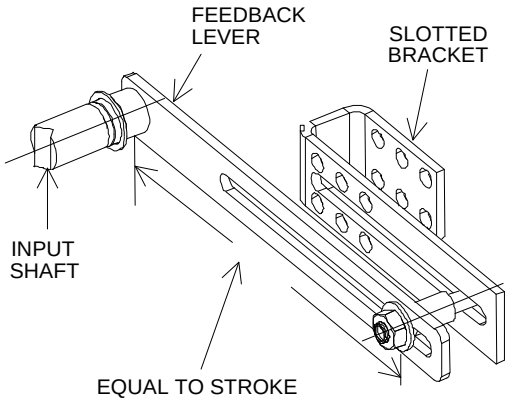
It may be necessary to separate the pin from the feedback lever to facilitate installation.



A. CONTROLLER MOUNTING AND PREFERRED METHOD OF CONNECTING FEEDBACK PIN



B. PREFERRED METHOD OF STROKE SETTING FOR FEEDBACK PIN CONNECTION. FEEDBACK LEVER SHOWN AT MID-STROKE.



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C. METHOD OF CONNECTING FEEDBACK PIN AND STROKE SETTING

FIGURE 3-2 Controller Mounting and Feedback Pin Connection

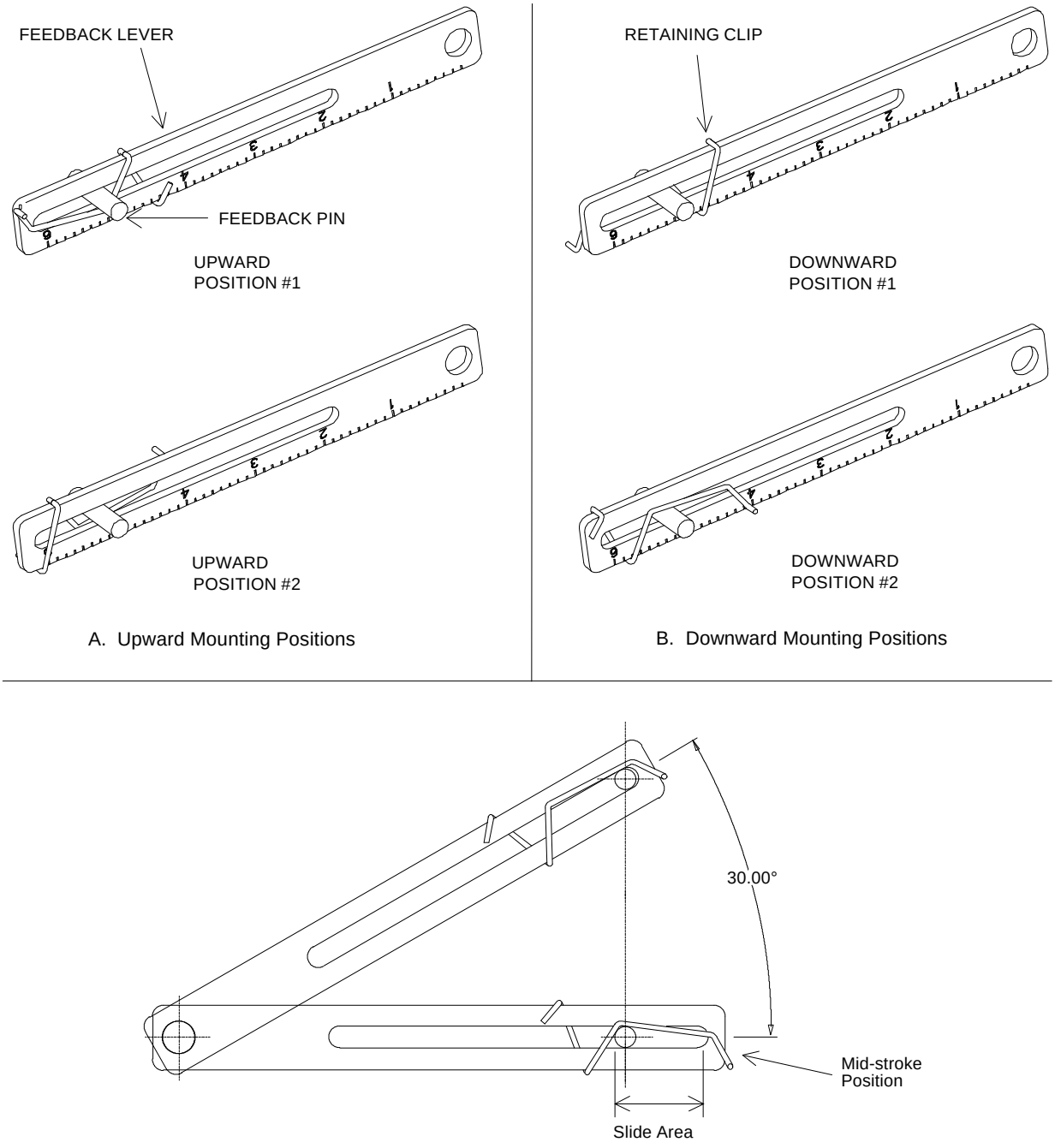


FIGURE 3-3 Retaining Clip Position

3.2 INPUTS/OUTPUTS

As shown in the block diagram below, the ValvePAC has the following inputs and outputs:

- Setpoint signal for valve position (when configured as a valve controller) or for a PID controller (when configured with a process controller)
- Actuator pressure
- Valve position
- Process variable

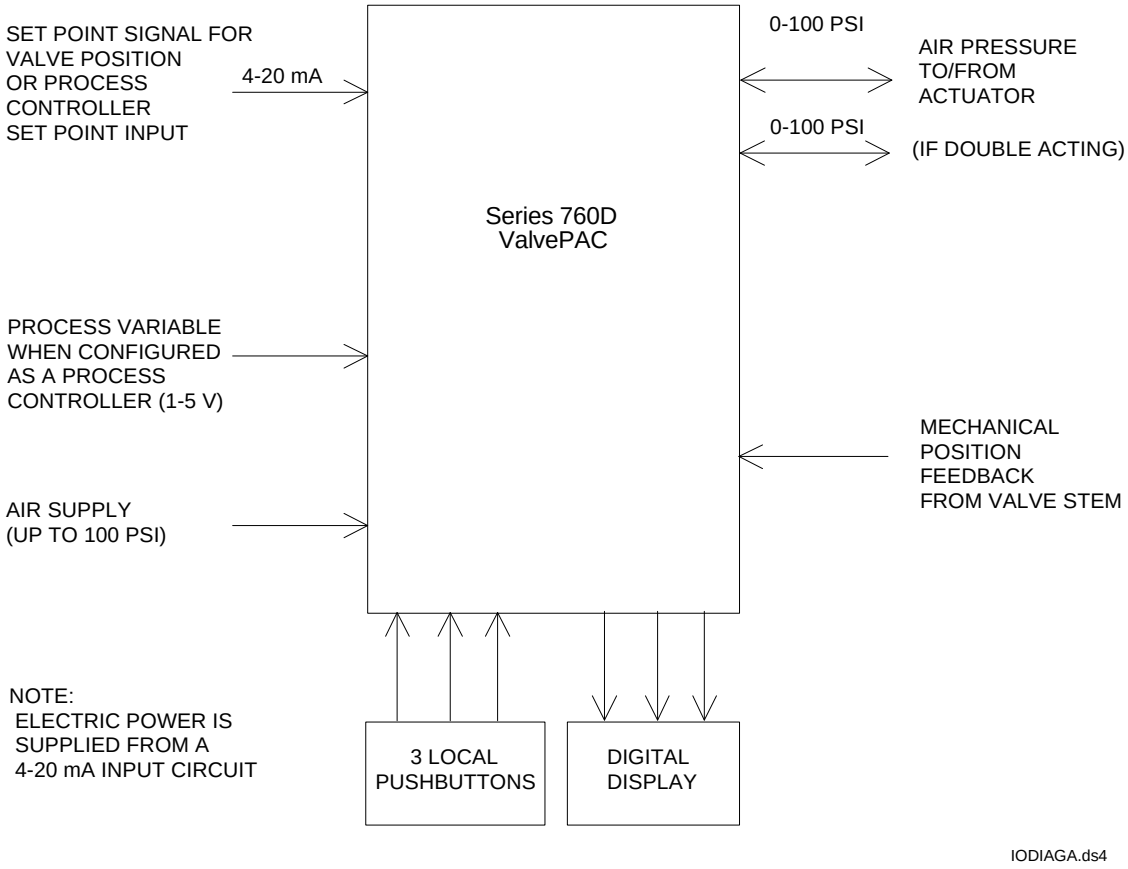

SET POINT SIGNAL FOR VALVE POSITION OR PROCESS CONTROLLER SET POINT INPUT
4-20 mA
0-100 PSI
AIR PRESSURE TO/FROM ACTUATOR
0-100 PSI
(IF DOUBLE ACTING)
Series 760D ValvePAC
PROCESS VARIABLE WHEN CONFIGURED AS A PROCESS CONTROLLER (1-5 V)
MECHANICAL POSITION FEEDBACK FROM VALVE STEM
AIR SUPPLY (UP TO 100 PSI)
NOTE:
ELECTRIC POWER IS SUPPLIED FROM A 4-20 mA INPUT CIRCUIT
3 LOCAL PUSHBUTTONS
DIGITAL DISPLAY
IODIAGA.ds4

FIGURE 3-4 Input/Output Diagram

3.2.1 Pneumatic Connections

The ValvePAC should be supplied with instrument quality air. Follow these guidelines for instrument quality air when making the pneumatic connections.

CAUTION

Synthetic compressor lubricants in the air stream at the controller may cause it to fail.

There are many types of synthetic lubricants. Some may not be compatible with the materials used in the construction of the ValvePAC. Wetting of these materials by such an oil mist or vapor may cause them to deteriorate. This can result in failure of the ValvePAC.

Requirements for a quality instrument air supply can be found in the Instrument Society of America's *Quality Standard for Instrument Air* (ISA-S7.3). Basically this standard calls for the following:

- Particle Size - The maximum particle size in the air stream at the instrument should be no larger than 3 microns.

- Dew Point - The dew point, at line pressure, should be at least 10° C (18° F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point, at line pressure, exceed 2° C (35.6° F).

- Oil Content - The maximum total oil or hydrocarbon content, exclusive of non-condensables, should not exceed 1 ppm under normal operating conditions.

3.2.2 Piping

Connect the controller to a source of clean, oil-free instrument air (Instrument air requirements are given in the preceding section). Failure to do so will increase the possibility of a malfunction or deviation from specified performance.

All pneumatic connections:

- 1/4" NPT (1/8” for gauges).

User supplied materials:

- Scale free piping at least 1/8" ID for standard flow models and 1/4" ID for high flow models.

- 1/4" NPT pipe fitting is needed for each connection used. Use care not to over-torque the fitting when tightening (12 ft-lb. maximum).

- 1/4" pipe plug to plug the unused port for single acting actuators.

Piping recommendations:

- Blow out all piping before connections are made to prevent dirt, chips, or debris from entering the controller.

- Use pipe sealant sparingly and only on male threads. A non-hardening sealant is strongly recommended.

NOTE

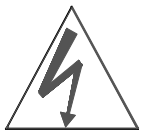
Pipe sealing tape is not recommended.

3.2.3 ValvePAC Connections

Pneumatic connections are shown in Figure 3-1 and listed below:

V2 - Output to actuator
S - Supply pressure to system
V1 - Output to actuator
E - Exhaust port. Can be piped away from controller. DO NOT PLUG.

Refer to the Table 3-1 to determine the required pneumatic connections between the ValvePAC and the actuator.



WARNING

Never exceed maximum supply pressure. Injury to personnel and damage to equipment may result. Maximum allowable air supply pressure to the controller varies according to actuator, valve size and valve type.

Plugging or applying pressure to the exhaust port will damage the unit and may cause personal injury. Pressure in excess of 100 psi in the V1, V2, or supply ports may cause damage to the controller. Supply pressure to the controller must not exceed actuator maximum pressure rating.

TABLE 3-1 Pneumatic Connections

ACTUATOR TYPE	CONTROLLER ACTION	CONNECTIONS
Single Acting	Direct Acting (output increases with increasing input signal)	Connect V2 and plug V1
Single Acting	Reverse Acting* (output decreases with increasing input signal)	Connect V2 and plug V1

TABLE 3-1 Pneumatic Connections (Continued)

ACTUATOR TYPE	CONTROLLER ACTION	CONNECTIONS
Double Acting	Direct Acting (V2 increases with increasing input signal)	1. Note the actuator position desired for the minimum input signal to the ValvePAC. 2. Connect V2 to the actuator port that causes the actuator to move away from the position noted in the Step 1. 3. Connect V1 to the remaining port.
Double Acting	Reverse Acting* (V2 decreases with increasing input signal)	1. Note the actuator position desired for the minimum input signal to the ValvePAC. 2. Connect V1 to the actuator port that causes the actuator to move away from the position noted in the Step 1. 3. Connect V2 to the remaining port.

* Reverse action is accomplished with the pushbuttons by setting SIG LO = the input current with the higher magnitude (e.g., 20 mA) and SIG HI = the input current with the lower magnitude (e.g. 4 mA)

3.3. ELECTRICAL CONNECTIONS

The following subsections provide information for installation in non-hazardous and hazardous locations.

3.3.1 Non-Hazardous Locations

An installation in a non-hazardous location should be in accordance with the current edition of the National Electrical Code (NEC) or Canadian Electrical Code (CEC), and all local electrical codes.

3.3.2 Hazardous Locations

IMPORTANT

An installation in a hazardous location must be in accordance with the current edition of the National Electrical Code (NEC) or Canadian Electrical Code (CEC), and all Local Electrical Codes.

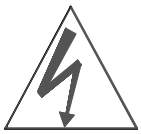
For installation in hazardous locations, the Controller must display the following:

The NEC or CEC hazardous location(s) for which the equipment is approved
The FM or CSA logo
Hazardous location classifications appropriate to the installation

Before installing a controller in a hazardous location, the need for energy limiting barriers and consideration of the FM entity parameters must be reviewed.

When electrically installing a Controller in a hazardous area, adhere to the guidelines on the control drawing, P/N 15032-7607, available from Moore upon request (see section 1.2, Product Support).

A typical system consists of a Controller installed in a hazardous area, energy limiting barriers installed in a non-hazardous location, and interconnecting twisted-pair wiring.



WARNING

Modifications to the Controller or installation of non-approved options will void the electrical approval.

CAUTION

In an intrinsically safe installation, follow code practice when servicing the instrument in the field.

3.3.2.1 Sira Certification Service Special Conditions for safe use (denoted by 'X' after certificate No.)

1. The following are the maximum input parameters:

A. Field Connector: +, - (Power Input)
- U_i = 30 Vdc
- I_i = 125 mA
- P_i = 0.9 W
- C_i = 2.2 nF
- L_i = 96 uH

B. Field Connector: A, B, C (Controller Link)
- U_i = 30 Vdc
- C_i = 0 uF
- L_i = 0 mH

Perform the following steps to install the ValvePAC in a hazardous location. Note that barriers may not be needed in an installation.

1. Install Controller as detailed in the preceding sections.

2. Install energy limiting barriers in the non-hazardous area. Refer to the barrier manufacturer's instructions and to the appropriate connection diagram in the control drawing, P/N 15032-7607, available from Moore upon request (see section 1.2, Product Support).

3. Install conduit for wiring to Controller. Install pull boxes as needed and remove burrs and sharp edges from conduit tubing.
4. Install wiring between Controller and barriers per the control drawing, P/N 15032-7607, available from Moore upon request (see section 1.2, Product Support). Ground the Controller. A barrier must be grounded and the resistance to ground must not exceed 1 ohm.

5. Install the wiring between barriers and output terminals of the Controller driving device.

6. Check all signal and ground connections before applying power.

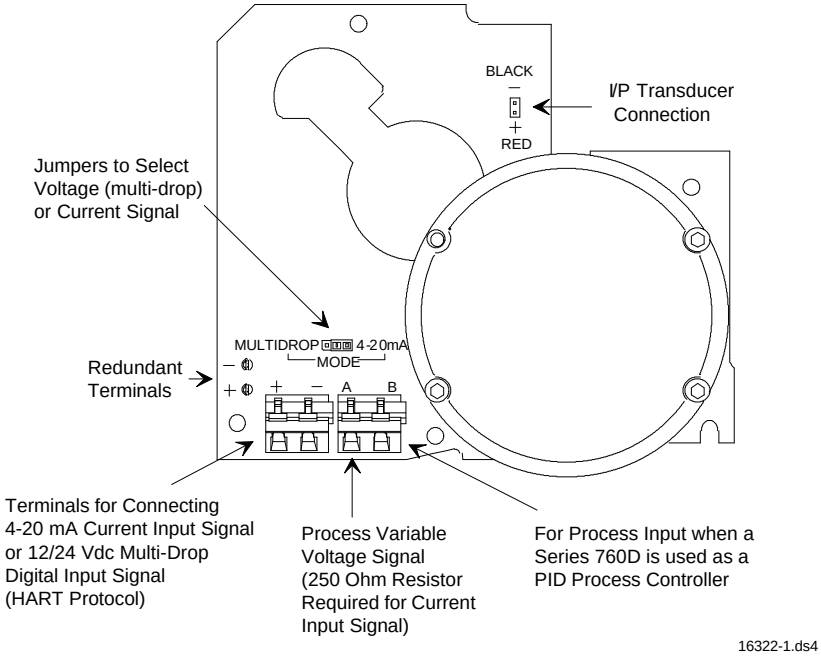

BLACK
I/P Transducer Connection
RED
Jumpers to Select Voltage (multi-drop) or Current Signal
MULTIDROP
4-20mA
MODE
Redundant Terminals
A
B
Terminals for Connecting 4-20 mA Current Input Signal or 12/24 Vdc Multi-Drop Digital Input Signal (HART Protocol)
Process Variable Voltage Signal (250 Ohm Resistor Required for Current Input Signal)
For Process Input when a Series 760D is used as a PID Process Controller
16322-1.ds4

FIGURE 3-5 Internal Wiring Connections

3.4 TYPICAL INSTALLATIONS

The following sections show the typical installations for the ValvePAC. Section 3.4.1 covers the installation as a Valve Controller and section 3.4.2 covers the installation as a Process Controller. Both sections have basic connection diagrams.

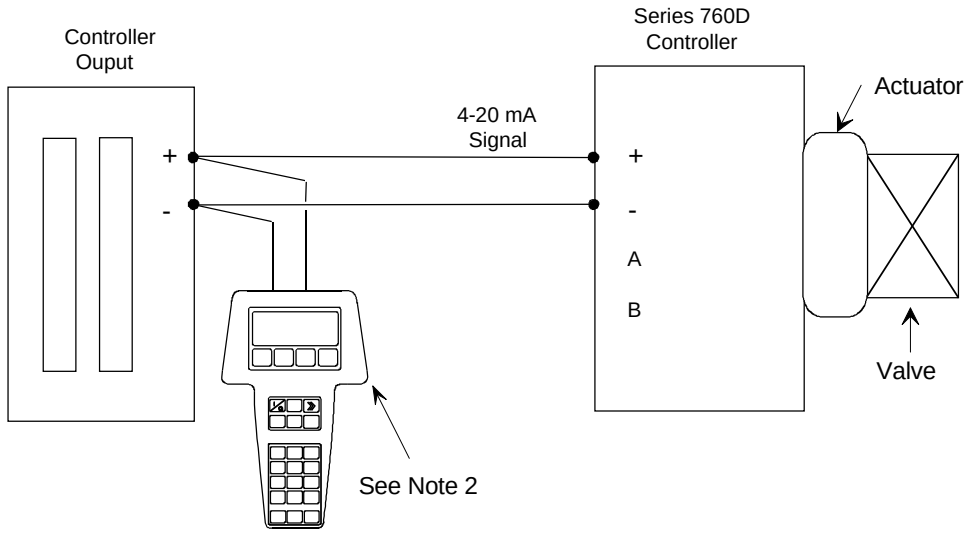
3.4.1 Valve Controller

The most basic setup for the ValvePAC is shown in Figure 3-6. The 4-20 mA signal is fed directly into the unit, which then moves the valve until its position matches the setpoint. This setup can provide a convenient way for a new user to learn and experiment with the ValvePAC.

NOTES

1. Use only shielded twisted pair wiring, or place wiring in conduit for any auxiliary field wiring installation. Do not expose the wiring to electromagnetic interference.

2. Connections to any device that operates under an independent source of power (e.g. a solenoid) violates the intrinsic safety certification of the ValvePAC.



NOTES:

1. Network resistance equals the sum of the barrier resistance and the current sense resistor. Minimum value is 250 Ohms; maximum value is 1100 Ohms.

2. Connect the HART Communicator as shown. The HART Communicator is a non-polar device.

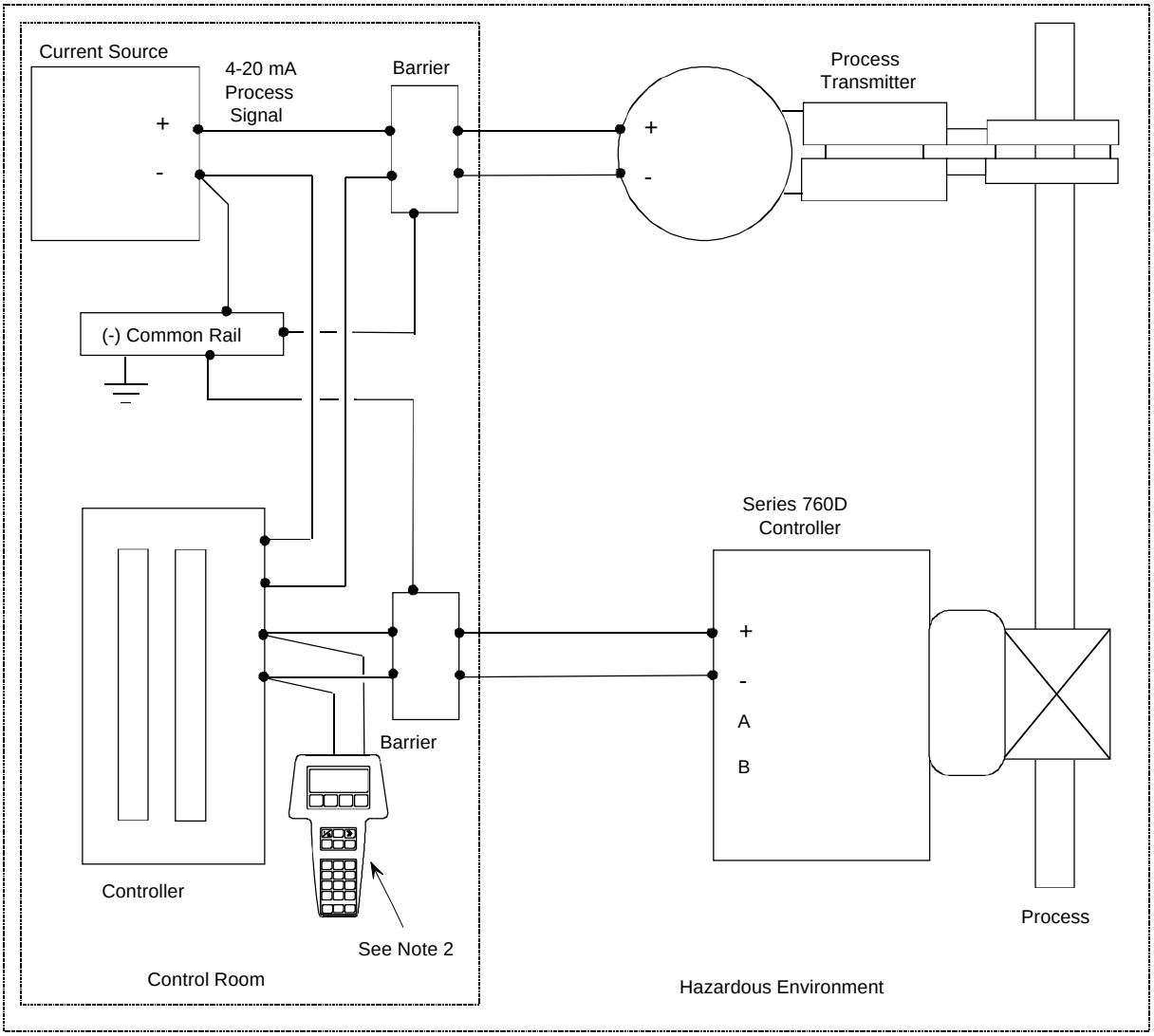
760D-11.ds4

FIGURE 3-6 Basic Valve Controller Setup

A typical system setup is shown in Figure 3-7. In the diagram, the ValvePAC is configured as a valve controller and is located in a hazardous area. Valve position is determined by an internal feedback potentiometer mechanically linked to the valve stem.

The process controller (or other source of input signal to the ValvePAC) is located in a non-hazardous location and an intrinsic safety barrier (with ground) can be placed between the process controller and the ValvePAC. A handheld communicator can be connected as shown. In a similar way, a PC equipped with a HART modem can also be connected. These communication links are not intrinsically safe, and must be connected to the circuit on the non hazardous side of the intrinsic safety barrier if the valve is located in a hazardous area.

The ValvePAC can be operated, calibrated, configured, and interrogated either by using local pushbuttons/display, a handheld HART communicator, or a remote PC running ValVue software.



NOTES:

1. Network resistance equals the sum of the barrier resistance and the current sense resistor. Minimum value is 250 Ohms; maximum value is 1100 Ohms.

2. Connect the HART Communicator as shown. The HART Communicator is a non-polar device.

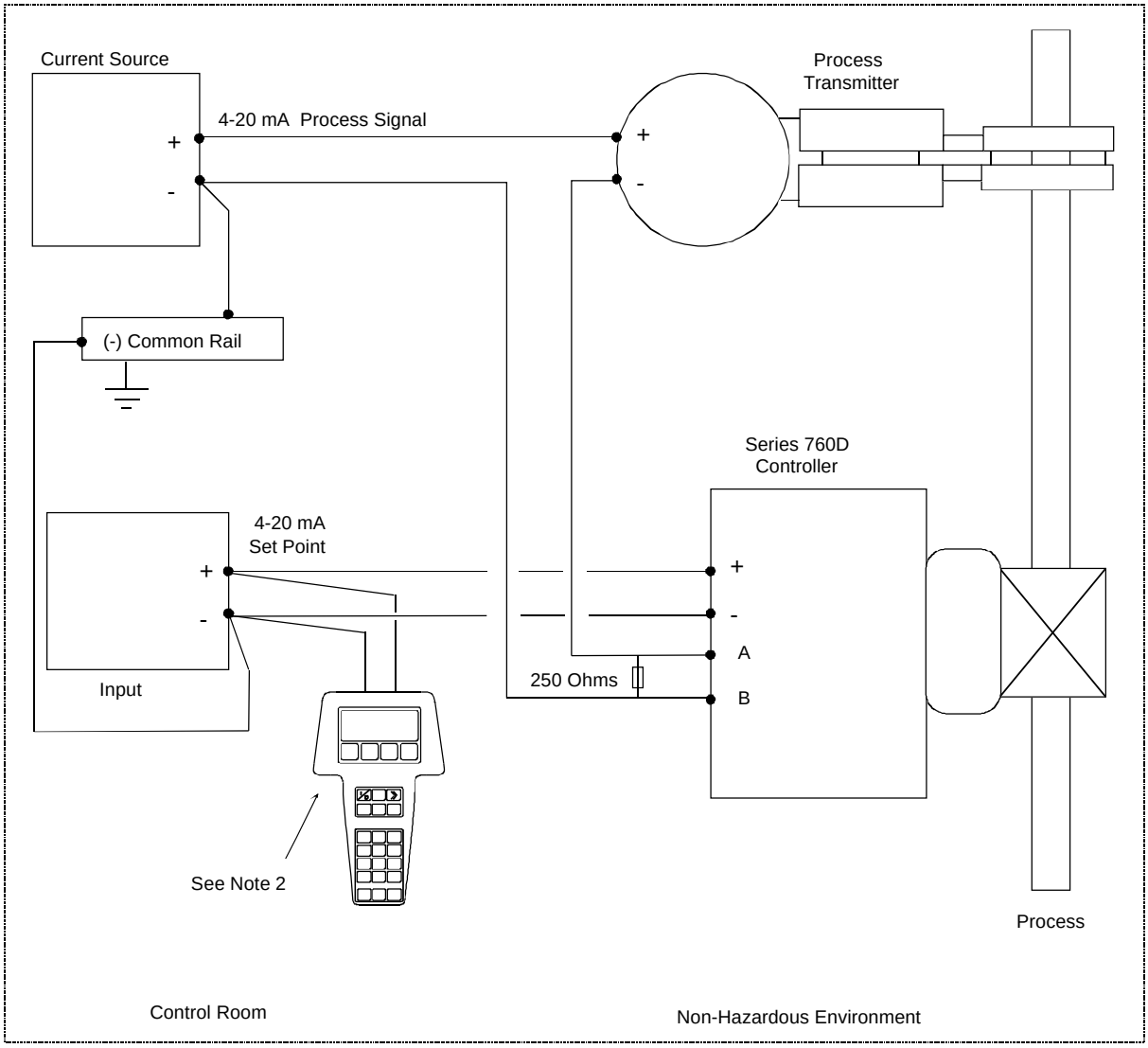
61098-2.ds4

FIGURE 3-7 System Diagram, Intrinsically Safe Installation

3.4.2 PROCESS CONTROLLER

The ValvePAC can be purchased from the factory with an onboard single loop PID controller. When this option is installed and turned on, the secondary input terminals (marked A and B) become active. The process variable feedback signal is measured across these terminals, typically as 1-5 volts. You can range this input. The primary input signal (measured across the + and - terminals) is used as the controller setpoint and must be between 4 and 20 mA to power the unit. In order to avoid loop errors, the - terminal of the primary signal and the B terminal of the secondary signal must operate within 0.2 volts of each other. They should both be referenced to the common rail. Various configuration schemes are illustrated in Figures 3-8 through 3-10.

The circuit shown in Figure 3-8 is the simplest configuration for the controller. It requires two two-wire lines to the field. The sense resistor is located across the A and B terminals of the ValvePAC unit. There is no sensing of the controlled variable in the control room, which is acceptable for applications such as a heat exchanger, where the primary variable is temperature and the secondary is flow. In such a case, the ValvePAC is the flow controller, and the control room temperature controller sets flow based on the requirements of the temperature loop (with no need to monitor flow in the control room).



NOTES:

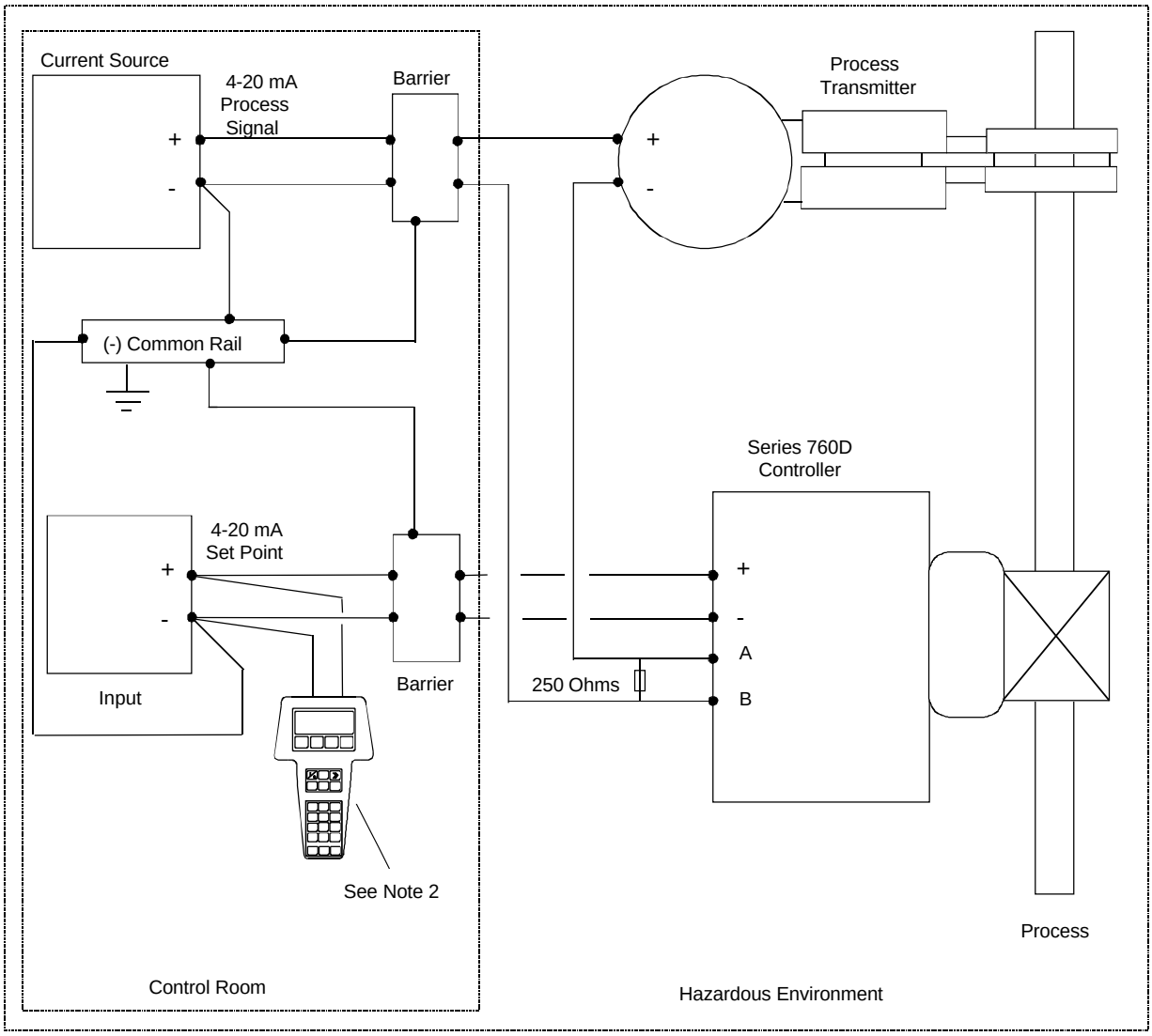
1. Network resistance equals the sum of the barrier resistance and the current sense resistor. Minimum value is 250 Ohms; maximum value is 1100 Ohms.

2. Connect the HART Communicator as shown. The HART Communicator is a non-polar device.

61098-5.ds4

FIGURE 3-8 Single Loop PID Configuration with No Process Feedback to Control Room

The circuit shown below is an intrinsically safe configuration. In this case, the 1-5 Vdc process signal is developed in the MTL 788R+ barrier and returned to the ValvePAC as a voltage signal. The 728+ barrier supplies the 4-20 mA to the ValvePAC. Note that the negative input to the ValvePAC and terminal B are at the same potential.



NOTES:

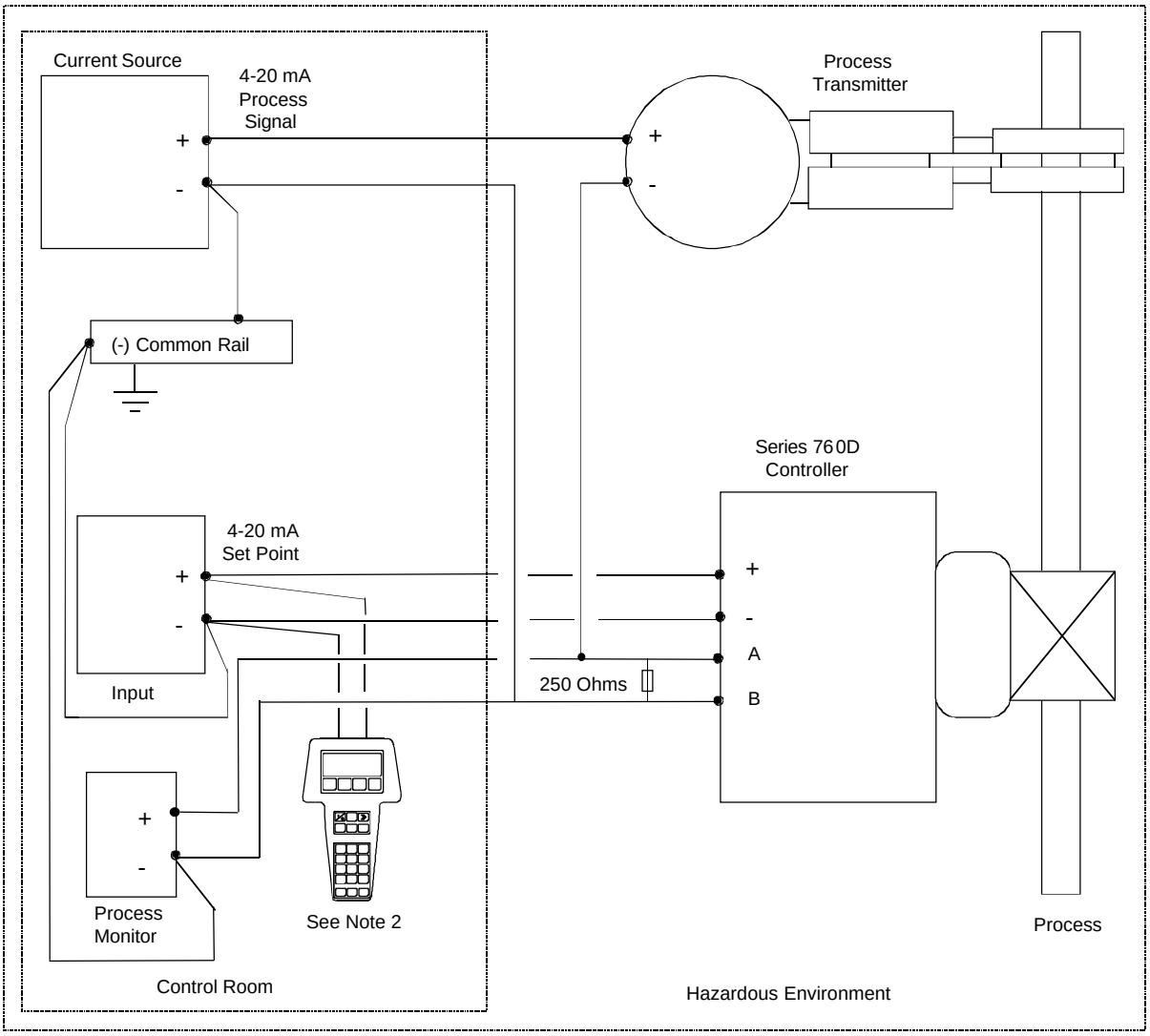
1. Network resistance equals the sum of the barrier resistance and the current sense resistor. Minimum value is 250 Ohms; maximum value is 1100 Ohms.

2. Connect the HART Communicator as shown. The HART Communicator is a non-polar device.

61098-6.ds4

FIGURE 3-9 Intrinsically Safe Single Loop PID Configuration with no Feedback to Control Room

In the configuration shown below, there are three 2-wire connections to the field. In the circuit shown, the controlled variable is sensed as a 1-5 V signal.



NOTES:

1. Network resistance equals the sum of the barrier resistance and the current sense resistor. Minimum value is 250 Ohms; maximum value is 1100 Ohms.

2. Connect the HART Communicator as shown. The HART Communicator is a non-polar device.

61098-7.ds4

FIGURE 3-10 Single Loop PID Configuration with Process Feedback to Control Room

■

4.0 OPERATION

This chapter discusses the fundamentals of operating the ValvePAC and the steps necessary to successfully configure and calibrate it.

Of key importance to the successful operation of the Series 760 ValvePAC is a good understanding of its command structure. Whether the commands are issued by the optional pushbuttons, a handheld communicator, or the optional ValVue software, the structure is the same.

Normal Mode - Used during normal operation and for display of configuration and calibration parameters.
Manual Mode - Used for configuration and calibration and to manually adjust the valve position.

Figure 4-2 illustrates the breakdown with the Normal Mode being on the left half of the chart and the Manual Mode being everything under the Manual menu.

4.1 PUSHBUTTONS/DISPLAY

When the ValvePAC powers up it will be in Normal Mode. The optional display shows the input signal, the actuator pressure, and the valve position. The display sequences from one variable to the next every 1.5 seconds.

Using the pushbuttons, you can exit from the Normal Operating Mode at any time and step through the menu structure to perform a wide range of manual operation, calibration, and configuration, and monitoring functions, all of which are described later in this chapter.

NOTES

1) If ValVue software is used, pushbuttons must be placed in the “unlocked” mode in order to operate.

2) If the ValvePAC is specified without local pushbuttons, local operation is not available.

As shown in Figure 4-1, the upper line is a 7-digit numeric display, and the lower line is a 7-digit alphanumeric display. The upper line is used for displaying values such as input signal or valve position, and the lower one is primarily used for messages and parameter identification.

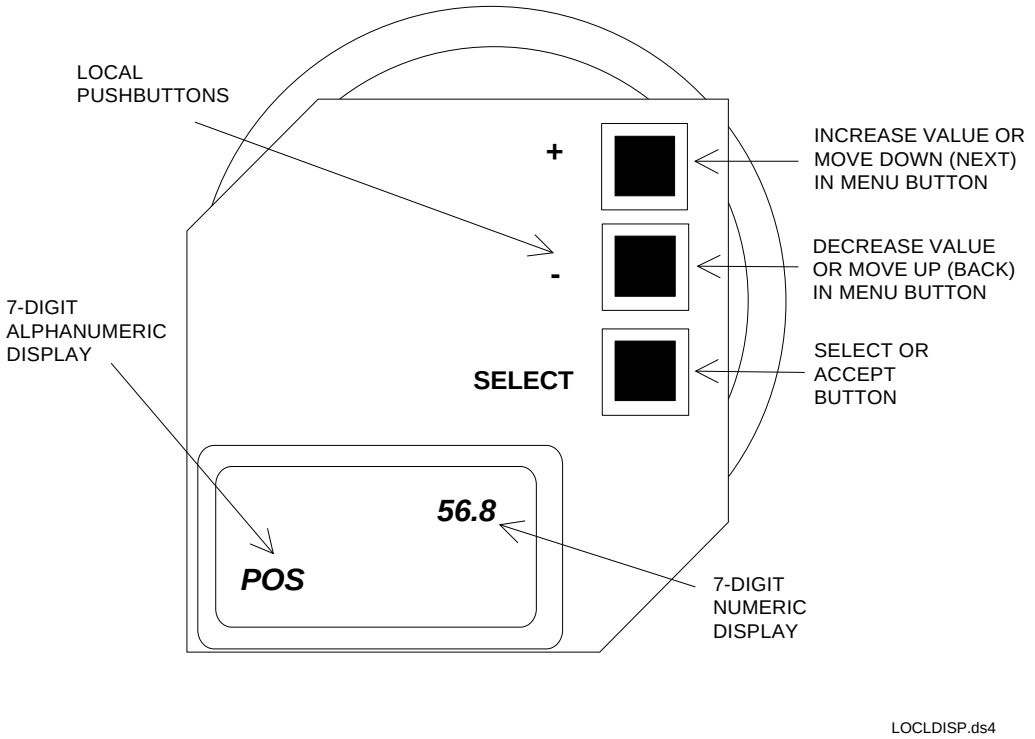


FIGURE 4-1 Local Display and Pushbuttons

The three pushbuttons perform the following functions:

- The lower button, marked with [*] permits you to “select” or “accept” the value or parameter option currently displayed.

- The middle button, marked [–] permits you to move back through the menu structure to the previous item in the menu, or to decrement the value currently shown in the digital display. When used to decrease a displayed value, holding this button down causes the value to decrease at a faster rate.

- The upper button, marked [+] permits you to move down through the menu structure to the next item in the menu, or to increment the value currently shown in the digital display. When used to increase a displayed value, holding this button down causes the value to increase at a faster rate.

To quickly identify the pushbutton sequence required to issue a particular command, refer to the complete map in Figure 4-2. Details are included in Figure 4-3 to Figure 4-7 and in the sections that follow.

NOTE

If the buttons are pushed after being locked by the ValVue software, the message “LOCKED” will appear.

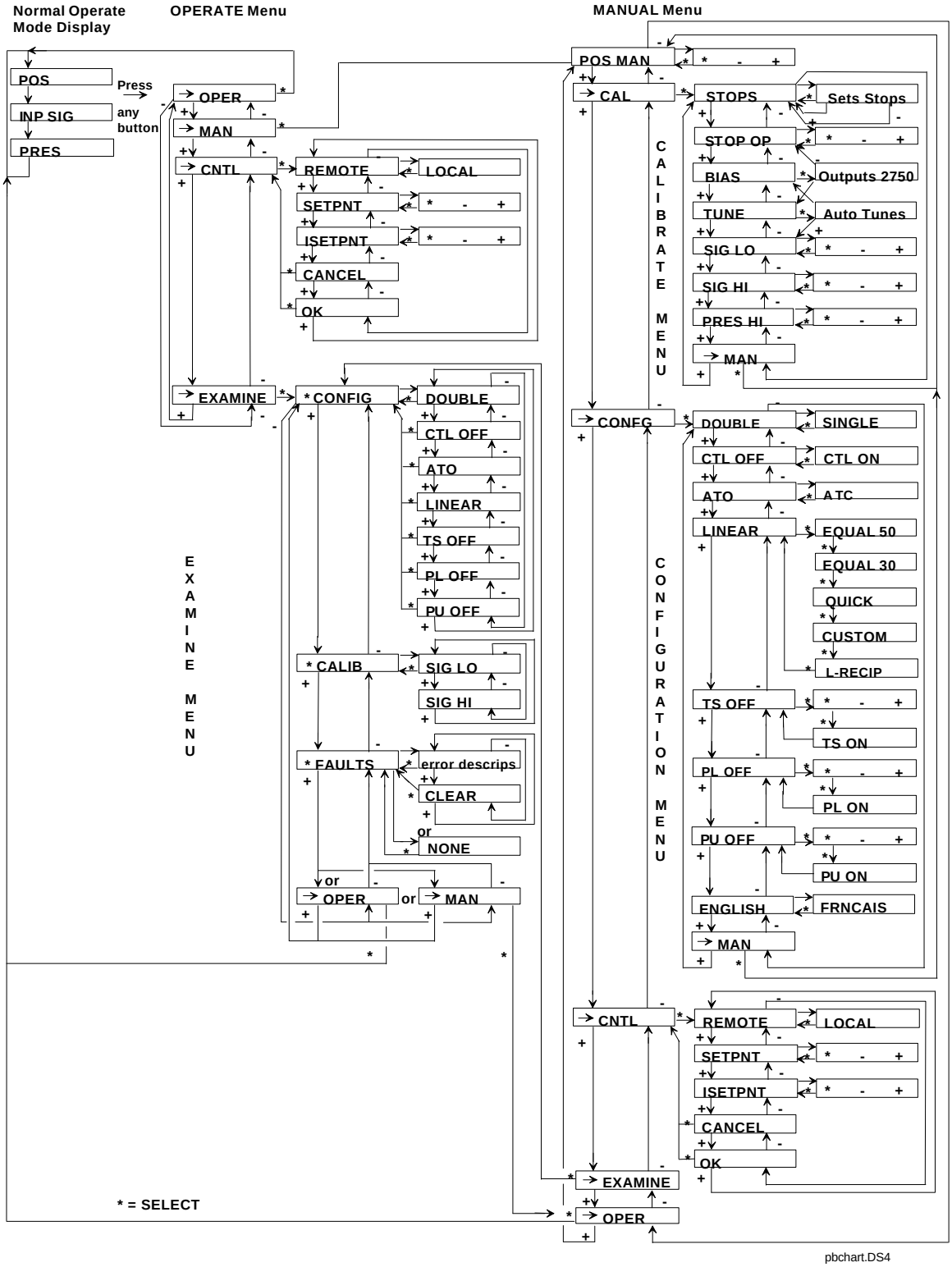


FIGURE 4-2 Master Pushbutton Function Menu

4.2 MENU STRUCTURE

The individual menu structures for operating the ValvePAC from the local pushbuttons and display are shown in Figure 4-3 to Figure 4-7 on the following pages.

4.2.1 Normal Operate Mode and Manual Mode Menus

When you leave Normal Operate mode to go to Manual mode, the valve is placed in the last position it was in when it left Normal Operate. When in Manual mode, the device will not respond to the 4-20 mA signals. However, the ValvePAC unit can still respond to HART commands including HART commands to position the valve.

NOTE

When you go to Examine from the Normal Operate Mode Menu, the valve is still in "Normal Operate" mode and still responds to the 4-20 mA signal.

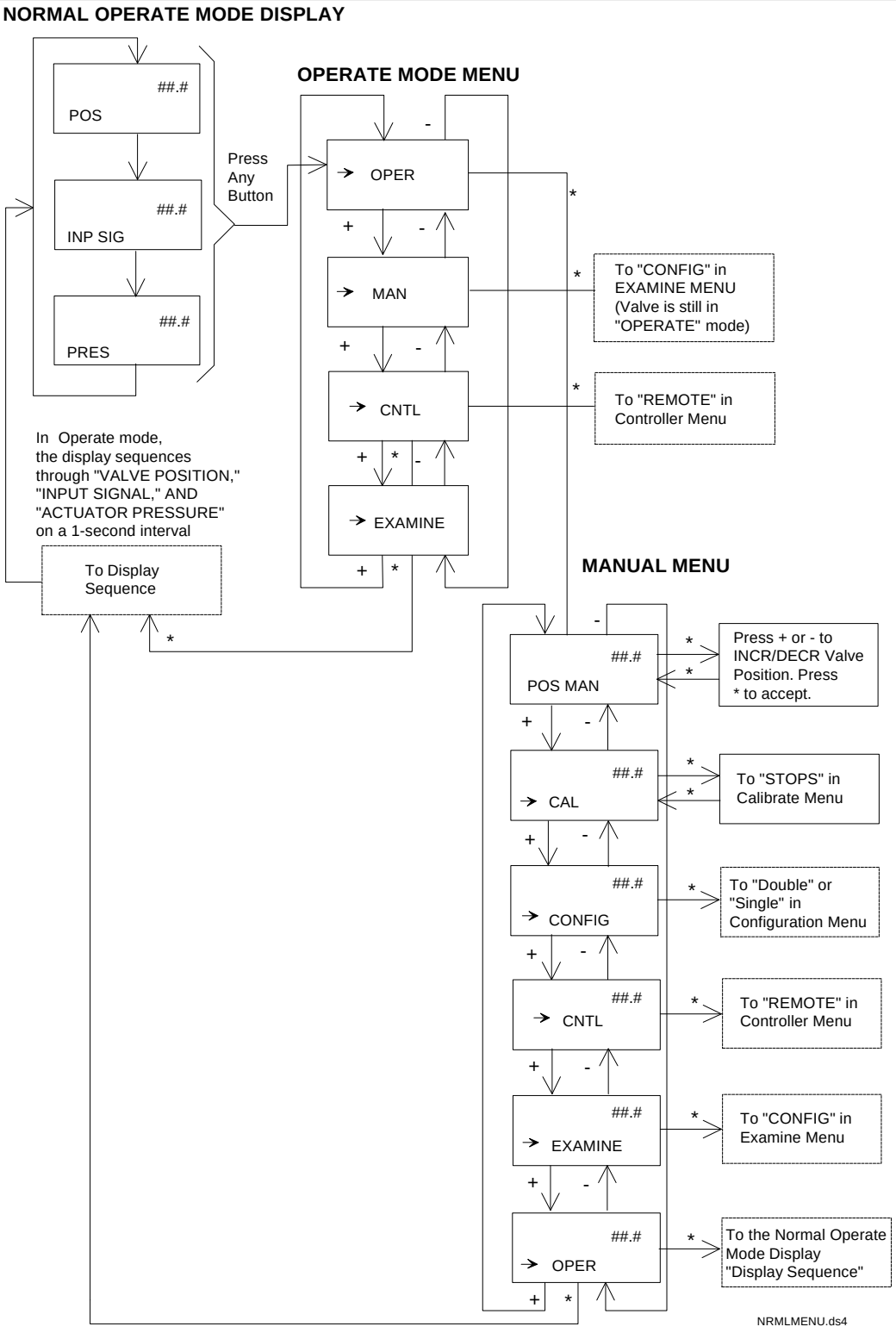


FIGURE 4-3 NORMAL OPERATE, MODE SELECT, and MANUAL Menu Structures

4.2.2 Configuration Menu

Because calibration depends on certain configuration options, you must perform “Configuration” before you perform “Calibration” when installing the ValvePAC the first time.

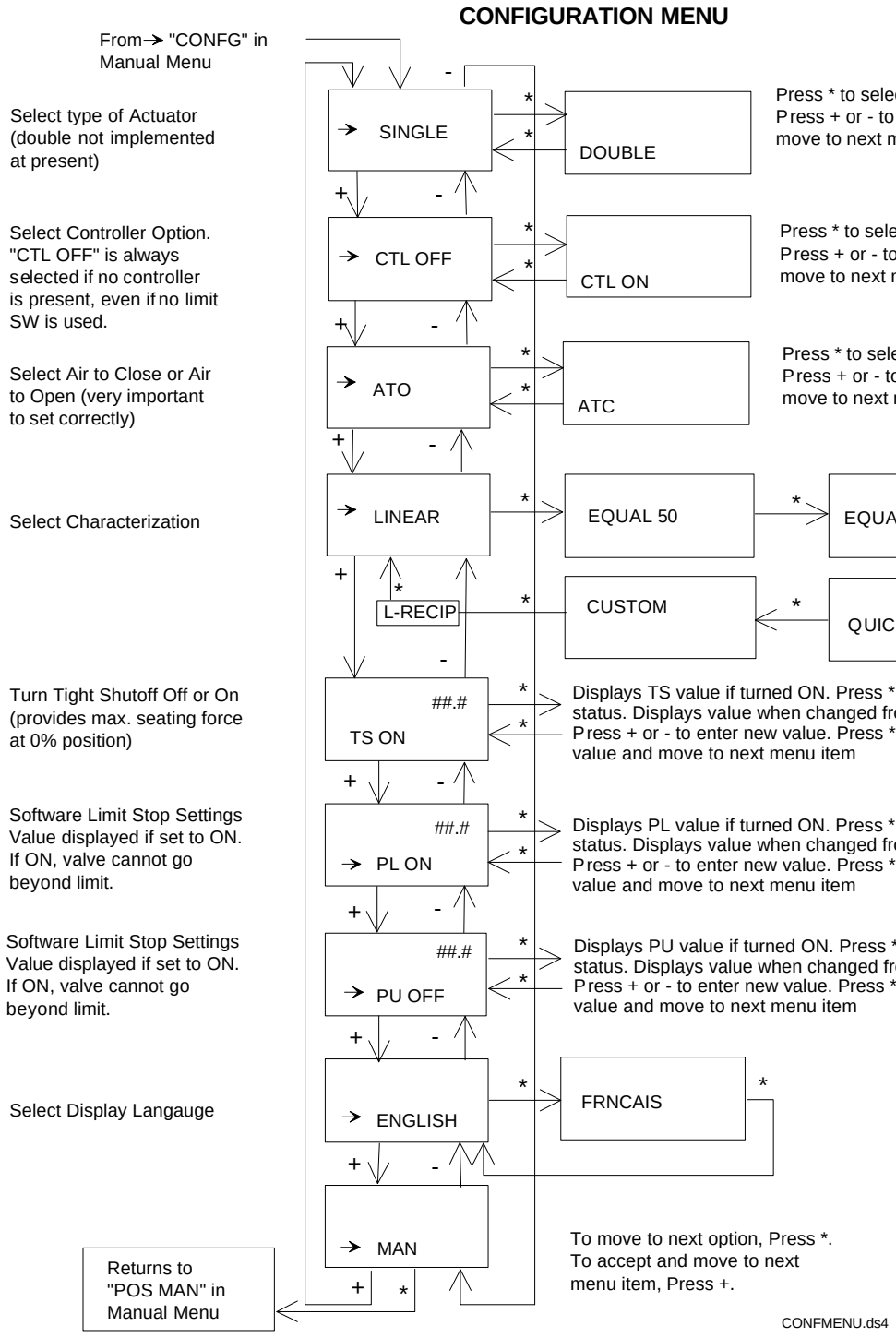

CONFIGURATION MENU
From→ "CONFG" in Manual Menu
Select type of Actuator (double not implemented at present)
SINGLE
DOUBLE
Press * to select option Press + or - to accept and move to next menu item
Select Controller Option. "CTL OFF" is always selected if no controller is present, even if no limit SW is used.
CTL OFF
CTL ON
Press * to select option Press + or - to accept and move to next menu item
Select Air to Close or Air to Open (very important to set correctly)
ATO
ATC
Press * to select option Press + or - to accept and move to next menu item
Select Characterization
LINEAR
EQUAL 50
EQUAL 30
L-RECIP
CUSTOM
QUICK
Turn Tight Shutoff Off or On (provides max. seating force at 0% position)
##.#
TS ON
Displays TS value if turned ON. Press * to change ON/OFF status. Displays value when changed from OFF to ON. Press + or - to enter new value. Press * to accept new value and move to next menu item
Software Limit Stop Settings Value displayed if set to ON. If ON, valve cannot go beyond limit.
##.#
PL ON
Displays PL value if turned ON. Press * to change ON/OFF status. Displays value when changed from OFF to ON. Press + or - to enter new value. Press * to accept new value and move to next menu item
Software Limit Stop Settings Value displayed if set to ON. If ON, valve cannot go beyond limit.
##.#
PU OFF
Displays PU value if turned ON. Press * to change ON/OFF status. Displays value when changed from OFF to ON. Press + or - to enter new value. Press * to accept new value and move to next menu item
Select Display Langauge
ENGLISH
FRNCAIS
MAN
To move to next option, Press *. To accept and move to next menu item, Press +.
Returns to "POS MAN" in Manual Menu
CONFMENU.ds4

FIGURE 4-4 CONFIGURATION Menu Structure

4.2.3 Calibrate Menu

If a change is made in the Air-to-Open/Air-to-Close or Direct/Reverse configuration options, or if you move the ValvePAC to a different valve or make any change to the valve position linkage, you must run the find “STOPS” calibration again.

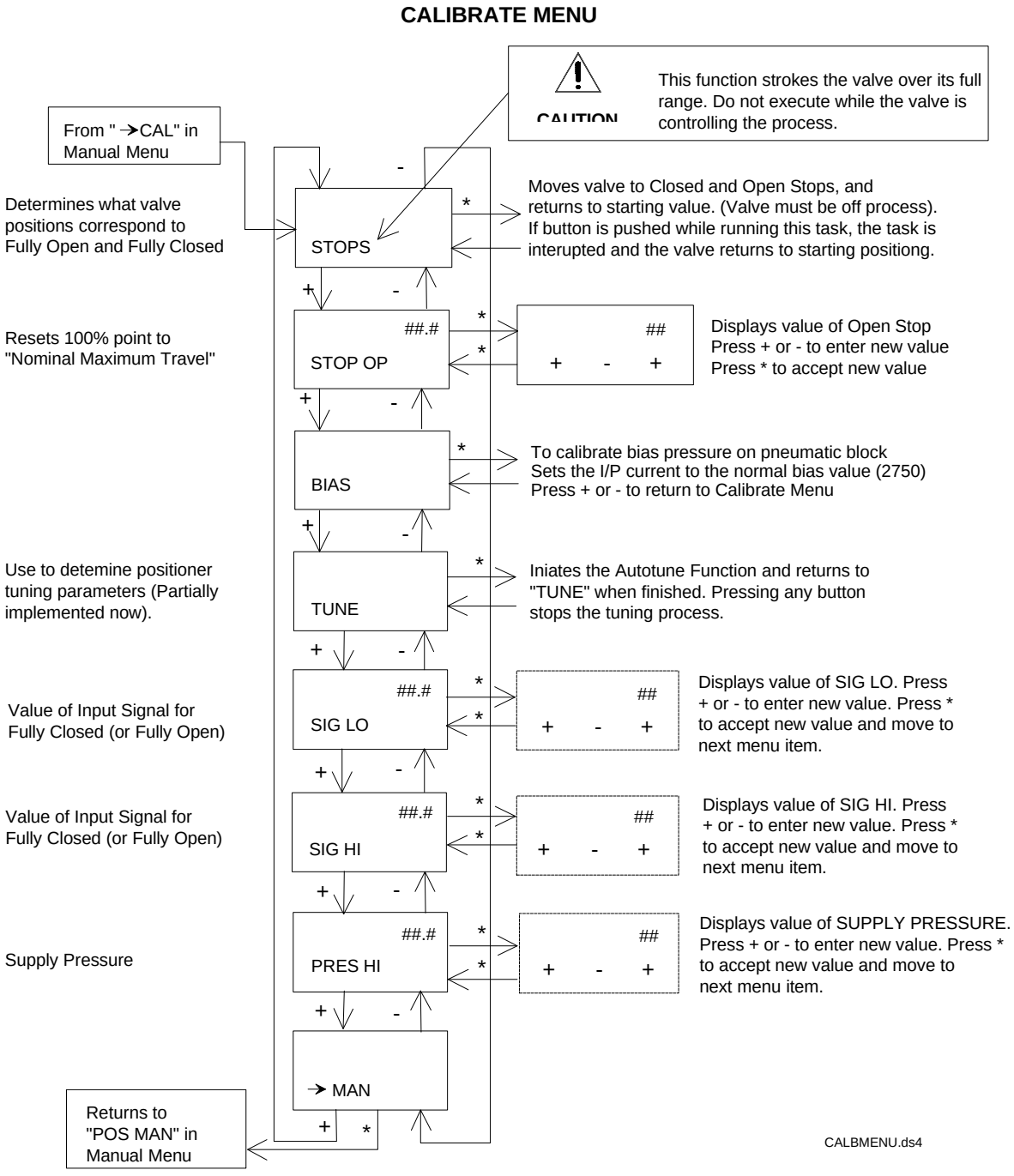

CALIBRATE MENU
CAUTION
This function strokes the valve over its full range. Do not execute while the valve is controlling the process.
From " →CAL" in Manual Menu
Determines what valve positions correspond to Fully Open and Fully Closed
STOPS
Moves valve to Closed and Open Stops, and returns to starting value. (Valve must be off process). If button is pushed while running this task, the task is interupted and the valve returns to starting positiong.
Resets 100% point to "Nominal Maximum Travel"
##.#
STOP OP
##
+ - +
Displays value of Open Stop Press + or - to enter new value Press * to accept new value
BIAS
To calibrate bias pressure on pneumatic block Sets the I/P current to the normal bias value (2750) Press + or - to return to Calibrate Menu
Use to detemine positioner tuning parameters (Partially implemented now).
TUNE
Iniates the Autotune Function and returns to "TUNE" when finished. Pressing any button stops the tuning process.
Value of Input Signal for Fully Closed (or Fully Open)
##.#
SIG LO
##
+ - +
Displays value of SIG LO. Press + or - to enter new value. Press * to accept new value and move to next menu item.
Value of Input Signal for Fully Closed (or Fully Open)
##.#
SIG HI
##
+ - +
Displays value of SIG HI. Press + or - to enter new value. Press * to accept new value and move to next menu item.
Supply Pressure
##.#
PRES HI
##
+ - +
Displays value of SUPPLY PRESSURE. Press + or - to enter new value. Press * to accept new value and move to next menu item.
→ MAN
Returns to "POS MAN" in Manual Menu
CALBMENU.ds4

FIGURE 4-5 CALIBRATE Menu Structures

4.2.4 Examine Menu

This menu (and the sub-menus shown in Figure 4-7) can be entered either from the Manual Mode Menu or from the Normal Operate Mode Menu. The Examine menu allows the user to read the current configuration, calibration, and status information. This information, however, cannot be changed from the Examine menu.

When you exit from the Examine menu, you return to the menu from which you entered.

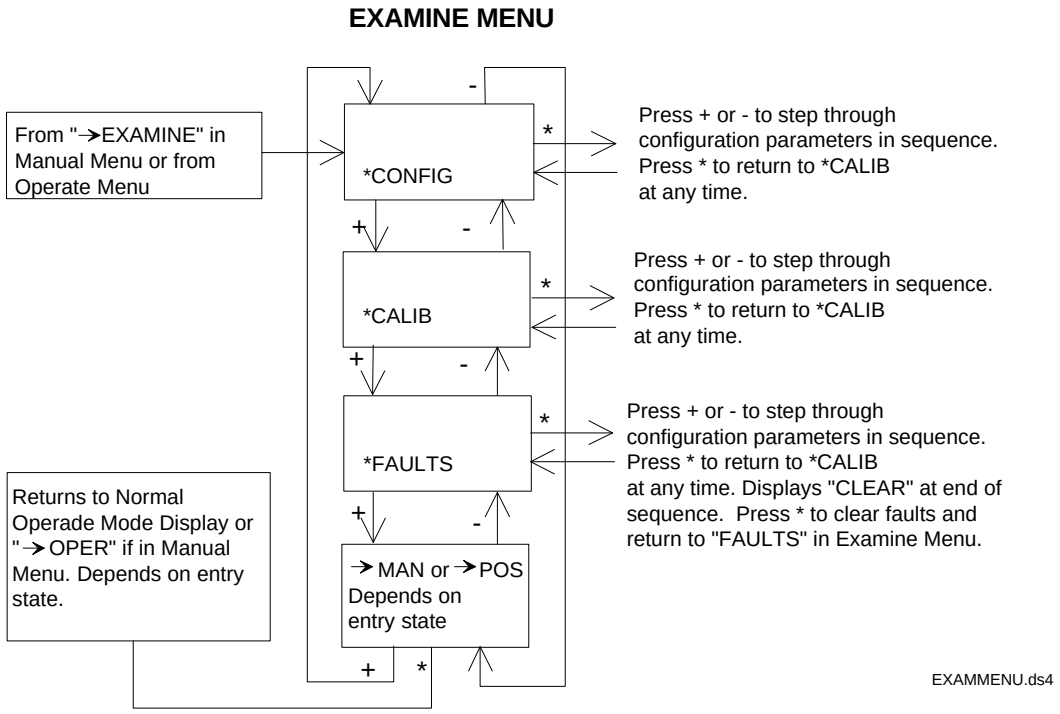

EXAMINE MENU
From "→EXAMINE" in Manual Menu or from Operate Menu
*CONFIG
*CALIB
*FAULTS
→MAN or →POS Depends on entry state
Returns to Normal Operade Mode Display or "→OPER" if in Manual Menu. Depends on entry state.
Press + or - to step through configuration parameters in sequence. Press * to return to *CALIB at any time.
Press + or - to step through configuration parameters in sequence. Press * to return to *CALIB at any time.
Press + or - to step through configuration parameters in sequence. Press * to return to *CALIB at any time. Displays "CLEAR" at end of sequence. Press * to clear faults and return to "FAULTS" in Examine Menu.
EXAMMENU.ds4

FIGURE 4-6 EXAMINE Menu Structure

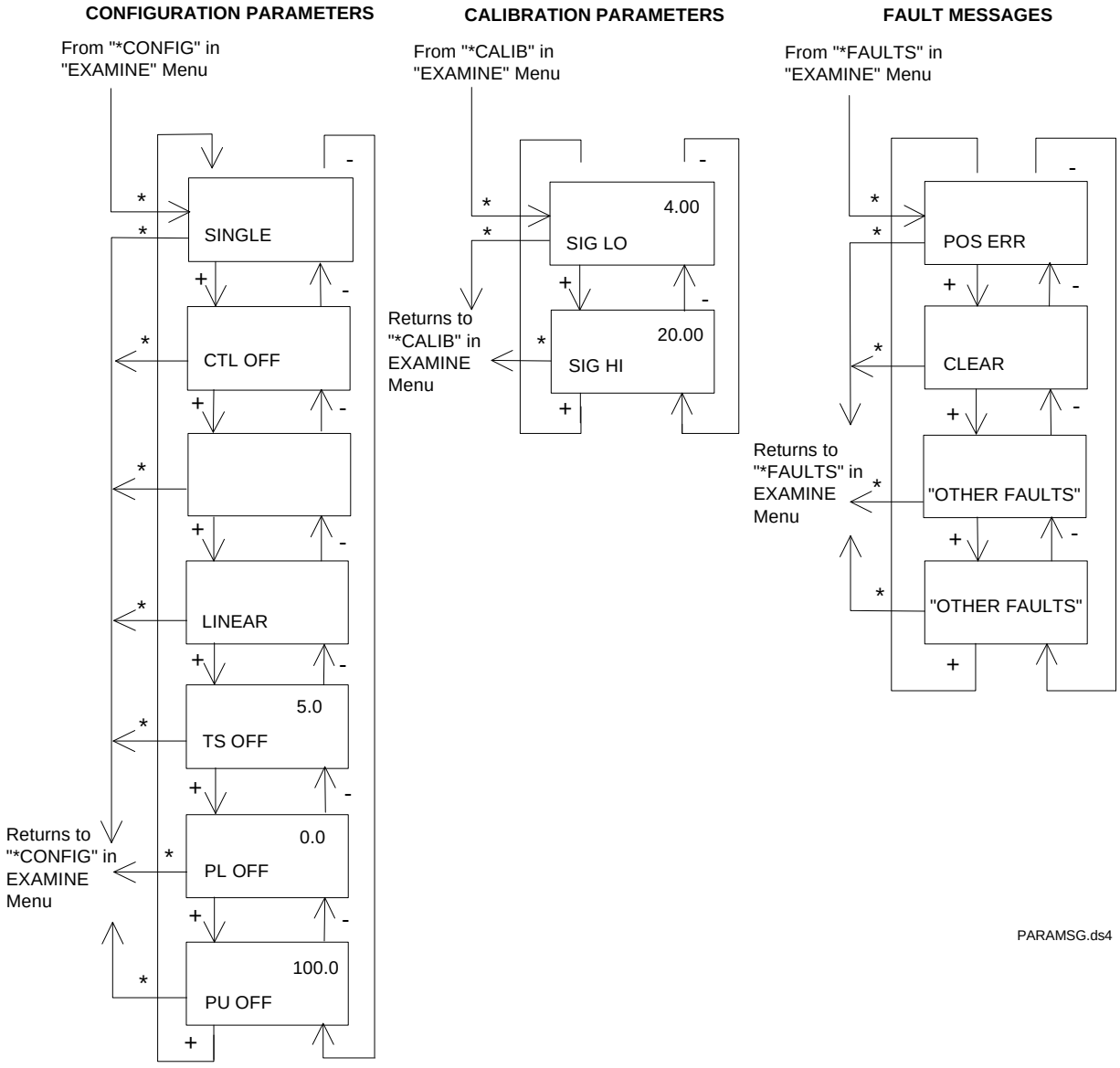


FIGURE 4-7 EXAMINE Sub-Menu Structure

4.3 NORMAL OPERATION

In normal operation, the ValvePAC unit operates as a controller using a 4-20 mA input signal as setpoint. The local digital display sequentially displays valve position, input signal, and actuator pressure on a 1.5-second interval. Pressing any button moves you to the → OPER option in the OPERATE MODE MENU, as shown in Figure 4-2.

The OPERATE MODE MENU has 3 options:

→ OPER (return to display of current position, pressure, and signal)
→ MAN (put valve in manual mode1 and go to MANUAL Menu)
→ CNTL (go to PID controller menu, if so equipped)
→ EXAMINE (go to EXAMINE Menu)

Use the pushbuttons to move from one option to the next. Press the * button to go to the item displayed in the menu.

To return to the Normal Operate Mode from any menu, press + or - repeatedly until → MAN or → OPER is displayed.

If → OPER appears, press * to return to Normal Operate Mode. If → MAN appears, press * to return to the Manual Mode menu. Press + repeatedly until → OPER appears. Press * to return to Normal Operate Mode and normal operation.

4.4 CONFIGURATION

The configurable options and how they appear on the display are described in Table 4-1.

NOTE
Configuration can only be done in the Manual Mode. Manual Mode can be accessed as described in section 4.4, Normal Operation.

TABLE 4-1 Local Configuration Options

Menu Item	Description of Options
SINGLE (or DOUBLE)	Select single or double acting actuator.
CTL OFF (or ON)	Select PID Process Controller function (OFF or ON) (if equipped).
ATO (or ATC)	Select Air-to-Open or Air-to-Close actuator operation.
LINEAR, EQUAL 50, EQUAL 30, QUICK, CUSTOM, L-RECIP	Select desired valve characteristic curve (linear-rotary, equal percentage 50, equal percentage 30, quick opening custom curve, or linear-reciprocating). The custom curve must have been entered through the remote PC.
TS (OFF or ON)	Display and set value of tight shutoff point. Default is 0.0%.
PL (OFF or ON)	Display and set value of the lower software position limit stop. Default is 0.0%.
PU (OFF or ON)	Display and set value of the upper software position limit stop. Default is 100.0%.
ENGLISH (or FRNCAIS)	Select language for displays (English or French).

4.4.1 Configuration Procedures (using pushbuttons)

NOTE

Supply air does not need to be connected at this time.

To configure the ValvePAC unit, execute the following procedures. Refer to the menu structures in Figure 4-2 through Figure 4-7 for assistance with the following procedures.

1. If in NORMAL OPERATE mode, press any button. →OPER will be displayed. Press + to get to the →MAN menu item.

2. Press * to move to MANUAL menu. This locks the valve in position and places it in MANUAL Mode. POS MAN is displayed.

3. Press + twice to move to →CONFIG option.

4. Press * to put the ValvePAC in the configure mode and display the first item in the CONFIGURATION menu.

5. In Single or Double, if option displayed is correct, press + to move to the next item. If not, press * to select the alternate choice. When OK, press + to move to next item.

6. In CTL ON (OFF), if option displayed is correct, press + to move to the next item. If not, press * to select the alternate choice. When OK, press + to move to the next item. CTL OFF. (Note: The controller is a factory installed option)

7. In ATO (ATC), if option displayed is correct, press + to move to the next item. If not, press * to select the alternate choice. When OK, press + to move to the next item.

8. In LINEAR (or other curve), if the option displayed is the one desired, press + to move to the next item. If not, press * to select the other options. When OK, press + to move to next item. If custom is selected, the custom curve must have been entered through the optional ValVue software program. The curve itself cannot be entered from the local pushbuttons.

9. The tight shutoff (TS) option allows the user to configure the controller to apply full supply pressure (or atmospheric pressure) to the actuator whenever the signal directs the valve “near” the closed position.

   If the tight shutoff option is on, the value of the TS option determines the “near” value at which the valve is forced fully shut. In TS OFF (ON), if status and value displayed are satisfactory, press + to move to next item. If not, press * to change on/off status and display value. Then press + or - buttons to increase or decrease value displayed. (When status is changed from ON to OFF, no value is displayed.) When value is OK, press * to accept value and move to next item.

10. The ValvePAC allows the user to configure a lower (PL) and upper (PU) software position limit stop. When in operation with these limits on, the valve will not move below the lower limit stop or above the upper limit stop.

CAUTION

These are software limit stops. If the ValvePAC fails for any reason including power failure or air failure, the ValvePAC cannot enforce these limit stops and the valve will go to fail-safe. Furthermore, the FULL OPEN AND FULL CLOSED buttons in ValVue bypass the limit stop controls. If safety requires the use of limit stops, mechanical limit stops should be used).

In PL OFF (ON), if status and value displayed are satisfactory, press + to move to next item. If not, press * to change on/off status and display value. Then press + or - buttons to increase or decrease value displayed. (When status is changed from ON to OFF, no value is displayed.) When value is OK, press * to accept value and move to next item.

11. In PU OFF (ON), if status and value displayed are satisfactory, press + to move to next item. If not, press * to change on/off status and display value. Then press + or - buttons to increase or decrease value displayed. (When status is changed from ON to OFF, no value is displayed.) When value is OK, press * to accept value and move to next item.

12. The ValvePAC local display may be configured to display English or French. If the language displayed is correct, press + to move to next item. If not, press * to display the other language option. When the desired language is displayed, press + to move to next item.

13. At →MAN, press + to move to the top of the CONFIGURATION menu, or - to move back to the previous item. To leave the CONFIGURATION menu, press *. This returns you to the Manual Menu.

This completes the configuration procedure.

4.5 CALIBRATION

You can perform the following calibration functions with the ValvePAC:

- Minimum and maximum stops for valve position
- Rezeroing
- Automatic tuning
- Low and high values for input signal
- Supply pressure (high value for actuator pressure output)

NOTE

Calibration can only be performed in the manual mode.

4.5.1 Calibration Procedures (using pushbuttons)

Because the final orientation of the unit cannot always be anticipated at the factory, it may be necessary to reposition the potentiometer's feedback gear. To check the gear's position, manually move the actuator though its full range of travel and observe the display. If, at any time, the word "FAILSAFE" appears, then the gear must be repositioned. Repositioning the feedback gear, such that the limits of its rotation bring it no closer than about one tooth away from losing contact with the input gear, should correct any problem. The feedback gear can be repositioned by loosening the screws that secure the feedback gear's mounting bracket to the housing (see Figure 4-8).

NOTE

After the potentiometer has been properly positioned, supply air must be connected to the unit before calibration can begin.

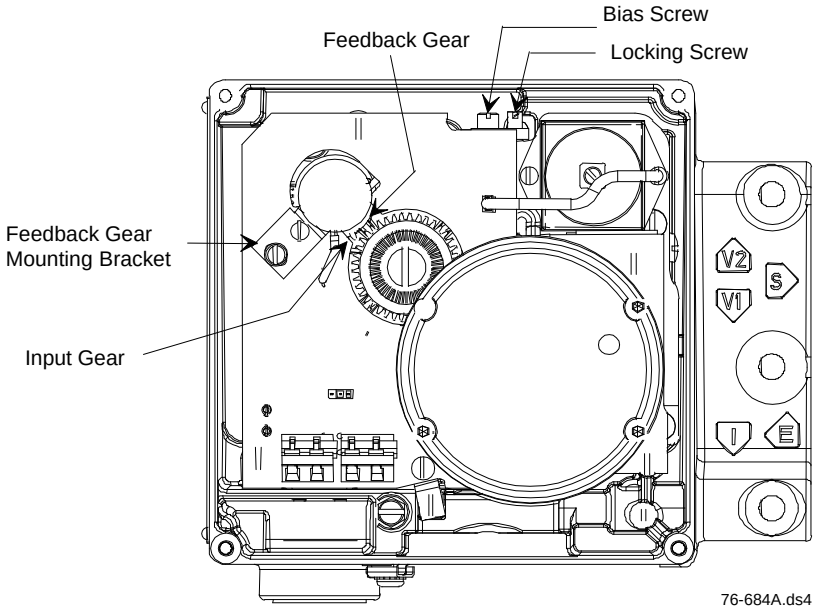


FIGURE 4-8 Feedback Gear, Feedback Gear Mounting Bracket, Input Gear, Bias Screw and Locking Screw

Refer to the menu structures in Figure 4-2 through Figure 4-7 for assistance with the following procedures.

CAUTION

Since some calibration functions stroke the valve over its full range, the valve should be isolated from the process before starting calibration.

To "calibrate" the ValvePAC unit using the local pushbuttons, execute the following procedure:

1. If in NORMAL mode, press any button and →OPER will be displayed. Press + to get to the →MAN menu item.

2. Press * to move to MANUAL MENU

3. Press + to move to →CAL option.

4. Press * to go to CALIBRATE menu.

5. In STOPS, press * to initiate the operation, which moves the valve to fully closed, then fully open, and then returns to the starting position. (This operation calibrates the end points for the position feedback potentiometer.) When the operation is complete, press + to move to the next item.

CAUTION

This function strokes the valve over its full range. Do not execute while valve is controlling the process.

6. On some valves, the full travel is larger than the nominal travel of the valve and it may be desirable to have the reported 100% position correspond to the nominal travel rather than the full stroke. The STOP OP option allows this correction. If a correction is to be made, press * to move valve to the 100% position. Using the + and - buttons, position the valve to the nominal full open position. Press * to accept this position as the new 100% position.

7. The Bias is the signal sent to the EPC (the internal I/P) that causes the actuator to neither fill nor exhaust. There is a large tolerance on the bias, but, if not set inside that tolerance, the EPC will not have an output range sufficient to drive the spool valve properly.

   In addition, the Auto Tune feature will not be successful unless the bias is within tolerance. To maximize the chance for a successful initial calibration, the pneumatics are adjusted at the factory so that this value is near the center of the tolerance, 2750. If the pneumatics still need to be readjusted for any reason, the BIAS option should be selected by pressing *. This will output a value of 2750 to the EPC. The bias screw, shown in Figure 4-8, should be adjusted until the valve is nearly stationary near mid travel. Remember to loosen, then tighten the locking plate at the top of the adjustment screw. Press + to move to the next menu item.

8. The TUNE menu item allows the user to initiate the automatic position control tuning function, which will select appropriate PID parameters for the position controller. This procedure will be most successful if the bias is in tolerance and the unit has been given the opportunity to fully stabilize after any recent step changes. Press * to initiate the AUTO TUNE function. This procedure may take from 1 to 5 minutes. During this time the valve will make a series of steps.

CAUTION

This procedure should not be performed while the valve is controlling the process. When the function is completed, return to TUNE. Press + to advance to the next item.

9. SIG LO displays the input signal that should correspond to the full closed or full open position of the valve (depending upon whether the valve is air-to-open or air-to-close, and whether the controller is direct or reverse). In SIG LO, if the displayed value is correct, press + to advance to the next item. If not, press * to display value of SIG LO. Use + and – buttons to change the value. When OK, press * to return to menu and move to next item.

10. SIG HI displays the input signal that should correspond to the full open or full closed position of the valve (depending upon whether the valve is air-to-open or air-to-close and whether the controller is direct or reverse). SIG HI must be larger than SIG LO by at least 5 mA. In SIG HI, if the displayed value is correct, press + to advance to the next item. If not, press * to display value of SIG HI. Use + and – buttons to change the value. When OK, press * to return to menu and move to next item.

11. The PRES HI menu item allows the user to enter the supply pressure. This pressure is used for scaling of the pressure data in the ValvePAC. In PRES HI, if the displayed value is correct, press + to advance to the next item. If not, press * to display value of SIG LO. Use + and – buttons to change the value. When OK, press * to return to menu and move to next item.

12. Calibration as a controller is now complete. At →MAN, press * to return to the MANUAL mode.

4.6 USING THE PUSHBUTTONS TO ADJUST POSITION

After the unit has been configured and calibrated, it will respond to either the current input signal or the pushbuttons. To use the pushbuttons to move the valve, perform the following:

1. Starting with the Normal Mode Operating Display (the repeating input signal, actuator pressure, valve position sequence on the display) press any button.

2. Press + until MAN is displayed.

3. Press * to move into the Manual Mode. POS MAN will be displayed.

4. Press *.

5. Press + or - to move the valve as desired.

6. Press * when the valve is in position.

As long as the unit is in the Manual Mode, the valve will remain in position. If the unit is returned to the Normal Mode, the current signal will take over as the setpoint.

4.7 EXAMINE

The Examine Menu permits you to display calibration parameters, configuration parameters, and to display and/or clear fault status messages and codes. (Refer to Table 4-2 for explanations of fault messages.)

You can enter the Examine menu either from Normal Operate Mode or from Manual Mode. When entered from Manual Mode, the valve is locked in position. When entered from Normal Operate Mode, however, the valve still responds to changes in setpoint input signal and the values displayed change in accordance with changes in input signal.

When you exit from the Examine menu, you return to the menu from which you entered.

4.7.1 How to Enter the EXAMINE Menu

If in Normal Mode, and the Normal Operate Mode Display is shown (input signal, actuator pressure, valve position displayed in sequence), then:

1. Press any button.
2. Press + to move through the options until Examine is displayed.
3. Press * to go to the Examine menu. *CONFIG will appear on the display. (This leaves the valve in the Normal Mode).

If in Manual Mode, then:

1. Press + repeatedly until →EXAMINE is shown.
2. Press * to go to the Examine menu. *CONFIG will appear on the display.

4.7.2 Using EXAMINE to View Configuration Parameters

1. After entering the Examine menu, press *. (when *CONFIG is displayed).
2. Press + to move forward through the list of configuration values. Press - to move backwards.
3. Press * to return to *CONFIG at any time.

4.7.3 Using EXAMINE to View Calibration Parameters

1. After entering the Examine menu, press +. (when *CONFIG is displayed).
2. When *CALIB is displayed, press *.
3. Press + to move forward through the list of calibration values. Press - to move backwards.
4. Press * to return to *CALIB at any time.

4.7.4 Using EXAMINE to Display/Clear Faults

1. After entering the EXAMINE menu, press + twice. (when *CONFIG is displayed).
2. When *FAULTS is displayed, press * to display the list of status values.
3. Press + to move forward through the list of faults in sequence. Press - to move backwards.

The last item in the list is CLEAR. When this message is displayed, you can clear all faults by pressing *. This will also return you to *FAULTS in the Examine menu. If you do not want to clear all fault messages, press + or - to move to another item in the list. You can then press * to return to *FAULTS in the Examine menu without clearing fault messages.

This completes the Examine functions.

4.8 FAULT MESSAGES

Table 4-2 lists the fault codes/messages that may appear on the display. The table also explains the meaning of each message, the probable cause of the fault, and recommended action you should take to correct the fault.

TABLE 4-2 Fault Messages

DISPLAY CODE	FAULT MESSAGE	MEANING	PROBALE CAUSE
POS ERR	Position Error	Valve position did not agree with ValvePAC output command within acceptable time	The valve did not go to the requested position within the time configured in "Position Error Time 1." • Valve lost air pressure • Valve movement is blocked • Setting of "Position Error Time 1" is too low for the size of valve
Note: Setting "Position Error Time 2" to a positive number may cause the device to fail-safe on a POSERR.			
BIAS ERR	I/P Output at null point is out of range		The bias (the output to the EPC within the ValvePAC that controls the actuator fill/exhaust) is out of normal range. Adjust the bias as needed. This error indicates an improperly adjusted bias. If the ValvePAC once functioned properly, this error usually indicates an improperly working pneumatics section.
POS SEN	Position Sensor Error	The position sensor has failed or is not aligned properly	Failed or linkage aligned incorrectly
PRES SEN	Pressure Sensor Error	The pressure sensor has failed	The pressure sensor failed. While the ValvePAC can function in normal operation with a failed pressure sensor, other calibration functions depend upon the pressure sensor
SIG SEN	Current Sensor Error	The primary signal (4-20) sensor has failed	Failure
REF ERR	Reference Voltage Error	The A/D reference voltage is incorrect	Failure
SW ERR	Self Check Failure	ValvePAC failed self check diagnostics	Failure

TABLE 4-2 Fault Messages (continued)

DISPLAY CODE	FAULT MESSAGE	MEANING	PROBALE CAUSE
RESET	Reset	ValvePAC has reset since last status clear	A ValvePAC reset occurred because of a power loss or a command from ValVue.
OVER RUN	Data Overrun	Internal check failed to process data in time	Hardware failure
TEMP ERR	Circuit Temperature Error	Internal ValvePAC temperature out of range	The internal ValvePAC temperature is outside the normal operating temperature range in the ValvePAC specifications.
WRT ERR	EEProm Write Failed	Device failed to write to nonvolatile memory	A write of data to the internal permanent memory of the ValvePAC failed. If you detect this error, issue a reset and check the configuration and calibration parameters.
TIMER ERR	Watchdog Timer Timeout	ValvePAC failed to send D/A output within timeout	An internal timer that checks proper ValvePAC operation has timed out, indicating improper operation of the ValvePAC. On watchdog timer time-out, the ValvePAC issues a self reset. This error indicates that such a reset already occurred
CAL FAIL	Calibration Failed	Signal or pressure calibration	An attempt to recalibrate the primary or secondary signal or the pressure sensors failed. The normal cause is sending the ValvePAC calibration values outside the allowed range, or trying to calibrate two values too close together (e.g., with insufficient range for accurate calibration).
STOP ERR	Find Stops Failed	The auto pos calibration failed	The self-position calibration routine failed. The most likely causes are loss of air pressure or the pressure or position sensor not working properly.

■

5.0 TROUBLESHOOTING

5.1 INTRODUCTION

This chapter offers procedures and options to confirm setup and configuration and allows you to exhaust most service options before seeking assistance from a factory-trained technician. By first following these procedures, you can save time, prevent costly downtime, and provide the service technician with more detailed information about the possible problem.

5.1.1 Factory Service

Trained service personnel perform high-level ValvePAC troubleshooting and servicing. Should the ValvePAC unit require replacement of internal parts, the unit will be replaced with a new or rebuilt unit. An extensive replacement inventory is available for immediate shipment. If this service is needed, contact your local salesperson or contact Moore at www.mooreproducts.com.

5.2 FAIL-SAFE DISPLAY

5.2.1 Fail-Safe Considerations

A reading of Fail-Safe on the display indicates a fatal or non-fatal error in the ValvePAC and acknowledges that the computer holds the output in a fail-safe condition. The misplacement of the position sensor (potentiometer) is just one of many problems that can create a Fail-Safe error. Refer to "Using EXAMINE to Display/Clear Faults" for how to use the pushbuttons to view these errors.

NOTE

Not all errors are fatal (e.g., not all errors cause a fail-safe condition).

5.2.2 Latches

Certain errors occur and self-correct. The ValvePAC clears the bit in the status when the error disappears and uses latches to show you that an error occurred. This means that the unit will continue to operate, but you can still use the pushbutton procedure in "Using EXAMINE to Display/Clear Faults" to see what errors occurred (*FAULTS in the EXAMINE menu). For example, if power is temporarily lost, the RESET error will appear on the local display when the power returns. The unit will start operating properly again, and the RESET message will disappear, but the error notification will remain "latched" in the unit's memory until it is manually cleared. Errors that latch include RESET, POSSEN, PRESSEN, REFERR, and TEMPERR. Table 5-1 lists the error latches and defines each term.

TABLE 5-1 Error Latches

LATCHES	DESCRIPTION
CLEAR	
DRIFT	Drifting of epic voltage
HARTERR	Continuous communication error
HWERR	Hardware failed self-check
IP	Position sensor error caused switch to EPC mode
LIMERR	Change of position limits
OVERRUN	Data overrun error
POSERR	Position error
POSSEN	Position error
PRESER1	Pressure at limit, position is not
PRESER2	Valve is at limit, pressure is not
PRESSEN	Pressure sensor error
REFERR	Reference voltage error
RESET	Reset occurred
SIGSEN	Current sensor error
STOPERR	Find Stops procedure failed
SWERR	Software error
TEMPERR	Circuit board temperature out-of-range
WRT ERR	A write to the EEPROM failed

5.3 PROBLEMS AND SOLUTIONS

Below is a list of seven common problem areas followed by their solutions:

- Connections (pneumatic and electrical)
- Grounding
- Power-on
- HART communications
- Bias
- Auto Tune
- Position Instability

5.3.1 Connections

The ValvePAC includes connections for air supply, tubing and wiring (grounding of the case and the 4-20 mA signal). Proper fitting of these connections ensures optimum operation.

5.3.1.1 Pneumatic Connections

The ValvePAC requires a regulated air supply of clean, dry, oil-free instrument air conforming to the requirements of ISA-S-7.3, Quality Standard for Instrument Air.

The ValvePAC requires sufficient supply pressure to drive the actuator against its stops. For best results, the supply pressure should be about 5 psi higher than the pressure required to drive the actuator to its stops (refer to the actuator data plate for the actuator pressure range). For example, if the actuator is nominally 3 to 15 psi, set the supply pressure to approximately 20 psi. The maximum pressure that can be applied to the ValvePAC is 100 psi. Consult the factory if a higher pressure is required.

WARNING

Never exceed maximum supply pressure. Injury to personnel and damage to equipment may result. Maximum allowable air supply pressure to the controller varies according to actuator, valve size, and valve type. See pressure drop tables in valve catalog (user supplied) to determine correct controller supply pressure.

Plugging or applying pressure to the Exhaust port will damage the unit, and may cause personal injury. Pressure in excess of 100 psi in the V1, V2, or Supply ports may cause damage to the controller. Supply pressure to the controller must not exceed actuator maximum pressure rating.

In addition, the following conditions must be met:

1) The exhaust port must vent to atmosphere (e.g. no obstructions and not under water).

2) The actuator port(s) (V1 and /or V2) must be connected to the actuator. For best response times use tubing of 3/8-inch minimum size.

After disconnecting the electrical current to the ValvePAC, confirm that the pressure in V2 registers zero psi and that the valve sits against a stop.

Figure 5-1 illustrates the proper configuration of air supply and output.

NOTE

Air-to-open (ATO) requires a closed valve; air-to-close (ATC) requires a open valve.

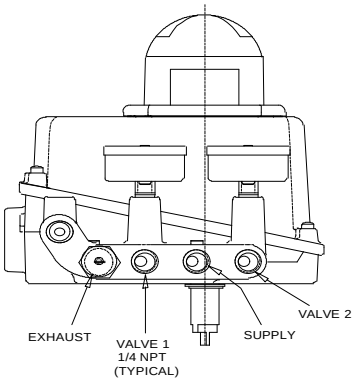


FIGURE 5-1 Exhaust, Actuator and Air Supply

5.3.1.2 Electrical Connections

The ValvePAC requires an electrical input from a 4 - 20 mA current source. The ValvePAC must be connected to an analog output of the control system.

Because the ValvePAC is polarity-sensitive, connect the positive (+) terminal to the positive lead and the negative terminal (–) to the negative lead.

Use the following one-step procedure to verify the wiring:

1. Connect a voltmeter across the ValvePAC terminals. Result: The voltage should read between 9.5 and 11.5 volts DC for any current input value between 3.8 and 22 mA.

NOTE

Test points, located adjacent to the terminal block, facilitate this measurement. These test points connect directly to the positive and negative terminals. These test points can also be used to connect a HART Handheld Communicator (if local electrical guidelines so permit).

TABLE 5-2 Electrical Connection Checklist

IF	THEN
Polarity is reversed.	Voltage usually exceeds 11.5 volts
Voltage measures less than 9.5 volts, and the polarity is correct.	Voltage compliance of the current source is inadequate to drive the ValvePAC and other series loads (e.g., a safety barrier or milliamp meter) in the loop.
Voltage measures above 11.5 volts, and the polarity is correct.	Check the position of the jumper on the terminal board. **NOTE** Use the mA jumper position for 4 to 20 mA applications, and the V position for multi-drop applications.

5.3.2 Grounding

In most cases, a plant's normal grounding practices apply to the ValvePAC. The ValvePAC does require the following grounding points:

A. Case ground

B. Signal ground

C. Process controller ground

Case Ground

Special screws on the inside, and the outside, of the case provide connections for the case ground.

Signal Ground

Follow normal practice for your facility. Most facilities reference the 4-20 mA signal ground to the ValvePAC, to the rear of the barrier box, or at the I/O card. You can reference any point in the loop to ground, but you must not ground more than once.

NOTE

Use only one ground reference in the loop.

Process Controller Ground

Use the following procedure for a ground reference only when the ValvePAC is supplied as a process controller.

1. Connect the auxiliary terminal B to the same ground reference as the negative current input terminal.

NOTE

The instruction manual indicates that the negative and B terminals are returned to the system common rail. Improperly grounded units can cause a 1/2% to 1% drift and affect auto-tuning performance.

2. To identify a noisy control loop, set the positioner to manual.

TABLE 5-3 Process Controller Ground Checklist

IF	THEN
The position is stable	The problem is noise in the control loop. **NOTE** Follow accepted wiring and grounding practice to correct a noisy control loop.

5.3.3 Power-On

You can apply power to the ValvePAC after checking the connections and grounding. Restoring power to the local ValvePAC creates one of five possible images on the local display:

A. Normal

B. Blank

C. "Fail-Safe"

D. Garbage

E. "Reset"

Normal Display

The normal display includes a numeric reading in the manual or normal mode on the ValvePAC display. The ValvePAC also may cycle between the three modes until a button is pushed. If you receive a normal display, no further action is required. Continue troubleshooting by going to the HART Communications section.

Blank Display

A blank display screen after startup indicates a power problem. This usually means unconnected electrical power wiring, or insufficient power sent to the ValvePAC. Use the following procedure to troubleshoot a blank display, or suspected power problem:

1. Check all wiring connections and confirm that the power is turned on

2. Use a test meter to evaluate system power. Expect readings of 24 volts for incoming power and at least 9 to 11.5 volts across the ValvePAC.

TABLE 5-4 Blank Display Checklist

IF	THEN
Voltage between the ValvePAC positive and negative terminals falls between 9 and 11.5 volts, and the display remains blank or shows a random set of segments.	Assume module failure and return it to the factory for replacement.
NOTE Disconnecting and re-connecting the current input may power-up the module. The module, however, remains marginal and requires replacement. Return it to the factory.	

"Fail-Safe" Display

If the display indicates ValvePAC operation in Fail-Safe mode, restart the ValvePAC by shutting down and then re-applying power. The ValvePAC usually displays the Fail-Safe mode because of incorrect installation of the position sensor (potentiometer).

The ValvePAC employs a 140 degree potentiometer. Valve rotation must not rotate the potentiometer beyond that 140 degrees (its limit is several degrees from each end of the scale). Improper installation (e.g., forcing the zero value off the end of the potentiometer, in either full open or full closed position) causes the valve to go to fail-safe mode.

The following procedure describes how to check and reset the potentiometer's position:

1. Use the pushbuttons or HART handheld communicator to enter the Manual mode, and go to the Calibrate menu. A bar graph on the local display indicates the true potentiometer position within the zero to 140 degree range.

2. Confirm that the actual installation settings fall within the zero to 140 degree range by moving the actuator and observing the bar graph. This step ensures that ValvePAC operates within proper limits of the potentiometer.

NOTE

The Fail-Safe message eliminates unrealistic and hard-to-determine results from improper potentiometer settings. Reaching the potentiometer limits automatically produces a Fail-Safe message.

3. If the potentiometer's limits are being exceeded, then it needs to be repositioned. Move the actuator to one of its stops, noting the direction that the feedback shaft will have to turn when the actuator moves away from that stop.

4. Loosen the potentiometer bracket's mounting screws and disengage the potentiometer gear from the main shaft gear.

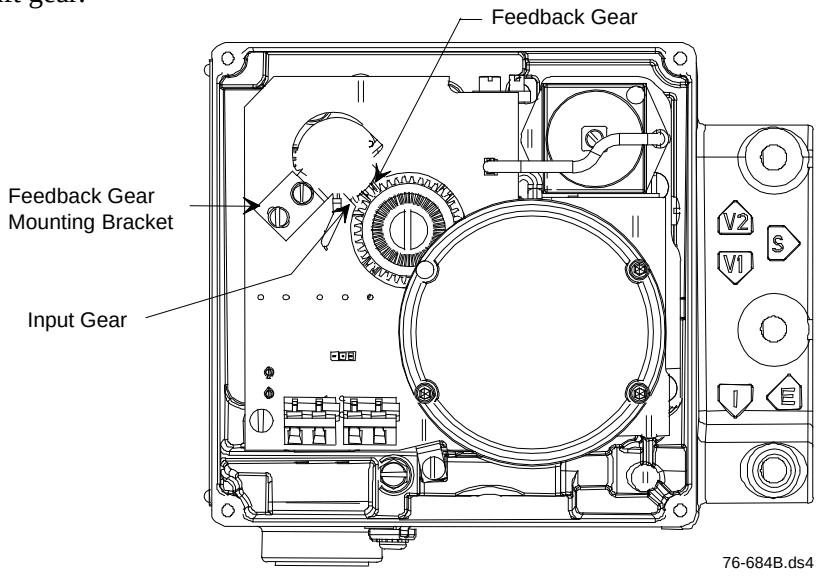


FIGURE 5-2 Feedback Gear, Feedback Mounting Bracket

5. Reposition the potentiometer gear such that "FAILSAFE" is not displayed and the shaft's eventual motion will move the gear away from the "FAILSAFE" zone. Re-engage it with the main shaft gear.

NOTE

When the actuator is on its stop, engaging the second tooth (from whichever end is appropriate given the direction of motion) of the potentiometer's sectored gear, will usually eliminate the FAILSAFE condition.

6. Tighten the bracket's mounting screws.

The optional ValVue software reports values of zero and 32,767 at the extreme ends of potentiometer travel, and provides a nPos response to message 141 "Read Raw Data." A properly positioned potentiometer never reaches these extremes because the ValvePAC declares the value "Bad" if not between 327 and 32,440.

Garbage Display

A display containing "garbage" (e.g. indecipherable characters) indicates that the ValvePAC microprocessor is not starting up properly due to a lack of power (refer to "Blank Display"). Check the electrical wiring or power. Random text or numbers indicates a working, but flawed, microprocessor. If checking power connections does not resolve the problem, return the unit to the factory for servicing.

"Reset" Display

The display shows the Reset setting when power reaches the unit. This display stops when the ValvePAC resets itself. If the Reset message repeats continuously, without stopping, assume an electronic fault and replace the unit.

5.3.4 HART Communications

This section contains information about computer and peripheral connections necessary to achieve proper communication, so that ValvePAC can communicate with a hand-held device or the optional ValVue software.

HART Compliance

The ValvePAC requires a HART-compliant communications loop. The HART protocol specifies the noise level, impedance requirements and configuration of the loop.

NOTES

1) When an intrinsically safe barrier separates the communicating device, a HART-compliant barrier must be used.

2) Before calling for technical support with suspected HART compliance problems, prepare a detailed description of the control loop, including all devices on the loop and the type of wiring used.

Conventional current output loops consisting of the following components usually meet requirements for HART compliance:

- Quality current source (e.g., low noise, high-impedance)
- Loop impedance of 250 ohms or more
- Twisted pair cable meeting the requirements of the 4-20 mA standard

Hand-held Settings

If the hand-held communicator fails to communicate with the ValvePAC, perform the following procedure:

NOTE

The communication connection of a HART 275 hand-held terminal is not polarity sensitive.

1. Check the device description. A hand-held terminal must include the ValvePAC device description in order to perform diagnostic and calibration functions. The HART 275 hand-held terminal must report the primary and secondary variable, tag, message, and other basic values.

2. Verify that the wiring contacts are in good condition.

3. Verify that there is no other HART master device in service, such as the optional ValVue software. The ValvePAC accepts only one master device at a time.

5.3.5 Bias Adjustment

As has been already discussed in the “Calibration Procedures” and “Bias” sections, the bias is the signal sent to the EPC (the I/P transducer) that holds the spool valve in a steady state condition and causes the actuator to neither fill nor exhaust. If the bias spring is improperly adjusted, the EPC will not have the output range necessary to adequately move the beam and spool valve in response to step changes.

Moore adjusts the bias at the factory in order to accommodate most environmental effects. Situations do arise, however, when bias adjustment becomes necessary. For example, after replacing the spool valve, or when the unit experiences extreme environmental conditions, adjusting the bias can optimize positioner performance.

Bias adjustment becomes necessary in the following instances:

After calibrating the limit stops of the valve and setting the parameters, an offset may occur between the ValvePAC position indicated on ValVue (or in the push-button display) and the actual valve position. This offset indicates the need for bias adjustment.

On start-up, after leaving the unit without power for an extended period of time, an offset sometimes occurs between the signal and actual valve position. On start-up, this offset begins moving slowly. This offset exists because the present bias setting differs from the setting recorded when the unit last saved the bias.

NOTE

The offset on startup resolves itself because the ValvePAC saves the bias value every hour, which provides a more accurate signal/valve position reading.

The optional ValVue software offers a live display of the bias value. If you suspect that the bias may be set incorrectly, and you do not have the software, you can reset it by following the bias procedure already described in "Calibration Procedures (using pushbuttons)."

NOTE

If no amount of bias screw adjustment is sufficient to move the valve, the unit likely contains a malfunctioning EPC and should be returned to the factory for replacement.

5.3.6 AutoTune

The AutoTune Procedure

The AutoTune procedure includes three steps:

- Bias search
- Estimate control parameters
- Refine control parameters

1. In Bias Search, the ValvePAC local displays values (such as 2753 and 2761) that approach, or converge on, a real Bias value. Expect the valve to move back and forth, slow down, and remain still by the end of this step.

2. In estimating control parameters, ValvePAC displays three types of values: input step sizes (such as 80 and 320), valve relative opening (such as 1874 and 1756), and dead time (such as 4.00 and 7.00). Expect the valve to move back and forth several times. ValvePAC uses these tests to estimate the preliminary control parameters based on position control characteristics.

3. In refining the estimated control parameters, ValvePAC displays several numbers (such as 1211 and 6). Interpret the number 1211 as the rising time (T98 is 12 x 0.05ms = 0.6 ms) and overshoot is 11%. The code number 6 indicates a specific control parameter adjustment

Evaluating the Results

A successful AutoTune provides position step responses, in both air fill and exhausting directions, that meet the tuning criteria. Overshoots range between 0 and 8%, and rising times range from 0.5 second for a small actuator to 1.5 second for a large actuator. A successful AutoTune updates the previous control parameters.

AutoTune usually results in fast position responses (0 to 8% overshoots). If you prefer a smooth response without overshoots, reduce the P value by 10 to 20%. If you prefer a slow response, set the damping coefficient at 1 to 9 (e.g., zero equals no damping, 9 equals maximum damping)

Damping Coefficient

The following table lists the damping coefficient, which displays after AutoTune and indicates the AutoTune result:

TABLE 5-5 Damping Coefficients

DAMPING COEFFICIENT	MESSAGE	ACTION
0	Self-tuning is successful.	None
33	The found Bias is not in the required range, and self-tuning is canceled.	Adjust the Bias
34	The found Bias is not in the required range, and self-tuning is canceled.	Adjust the Bias
55	The found Bias is not in the required range, and self-tuning is canceled.	Adjust the Bias
66	Self-tuning for air fill direction fails after 30 times trying.	Check supply pressure; check noise; check the pneumatic block, especially spool S/A
77	Self-tuning for air exhausting direction fails after 30 times tuning.	Check the pneumatic block, especially spool S/A

NOTE

The Damping Coefficient adjustment range is 0 to 9. The out-of-range value is equivalent to 0, or no damping.

Unacceptable Response Characteristics

Valve position responses depend on many factors including the condition of the valve, actuator and process; ambient temperature; noise; the ValvePAC itself; supply pressure; and the setup and step change size for the positioner control parameters.

NOTE

A 5% step change requires a change in the 20 to 80% opening range.

With damping coefficient of zero (no damping), consider the following valve responses unacceptable:

Overshoot greater than 20%
Rising time (T98) greater than 1.5 seconds for small actuators and 2.5 seconds for large actuators
Dead time greater than 0.5 seconds
Limit cycling peak-to-peak measurement greater than 0.5%
Position steady-state error greater than 0.5%

5.3.7 Position Instability

The possible sources of position instability include:

- Control loop (measurement) noise
- Process noise
- Oscillation
- Limit cycling
- Line frequency

Control loop noise only appears in the Normal mode (never the Manual mode). For best control, reduce control loop noise by re-tuning the process controller (in the ValvePAC or an external controller). You may also dampen the ValvePAC response.

Process noise results from process pressure and flow changes that apply forces to the valve plug and cause changes in position. Although the ValvePAC restores the plug position, the response is not instantaneous.

Set the following values to identify PID oscillation:

P = 20	Padj = 0
I = 0	Gamma = 0
D = 0	Damping = 0
	Dead Zone = 0

If the position remains stable, then the problem is related to the positioner settings of the PID. Re-run AutoTune.

The characteristics of limit cycling include at least a 4-second period and a squared off (as opposed to sinusoidal) trend record. Excessive friction in the valve/actuator assembly, or dirt in the spool valve assembly, can cause limit cycling. The ValvePAC diagnostic identifies excessive friction in the valve/actuator assembly as a reported friction value greater than 30% of the actuator span.

Poor grounding of the signals and case, or power supply ripple in the 4-20 mA control signal, can introduce line frequency noise. Line frequency noise converts to low-frequency noise when a noisy signal sampling occurs during a period not integrally related to the line frequency. The resulting frequency (e.g. alias) measures more than 1 Hz, a frequency too high for resolution by the process trend record.

A pulsating sound of escaping air at the exhaust port usually indicates line frequency noise. In extreme cases, the valve stem may appear to pulsate. Correct a line frequency noise problem by proper grounding, see “Electrical Connections,” or by eliminating ripple noise from the current source (HART compliance requires less than 4 μA of current ripple).

5.4 TROUBLESHOOTING CHECKLIST

The following is a list of possible problems and solutions, arranged in the order that they might be encountered during a typical installation.

TABLE 5-6 Trouble Shooting Checklist

STEP	ACTION	
POWER UP PROBLEMS		
1	Apply power to the ValvePAC	
	IF	THEN
	Display is normal.	Continue to Step 2.
	Display is blank.	Check electrical connections and voltage per "Blank Display."
	"FAILSAFE" shown on display.	1. Use the EXAMINE pushbutton menu to determine the cause. Clear the error and restart. 2. The potentiometer may be positioned incorrectly. See "Fail-Safe Display" for instructions.
	Display is indecipherable.	Check electrical connections and voltage per "Blank Display" section. If not a power problem return the unit to the factory.
	"RESET" shown on display.	It will appear momentarily when the unit is powered up. If it continues, return the unit to the factory.
HART PROBLEMS		
2	If a hand-held HART communicator (or the optional ValVue software) is to be used, connect it to the unit and attempt to establish communications.	
	IF	THEN
	Communication is successful.	Continue to Step 3.
	Communication is unsuccessful.	1. Verify that the 4-20 mA wires are not loose. 2. Verify that the correct device descriptor is being used. 3. Verify that the HART wires are clean and in good condition. 4. Verify that there is no other master device in service. 5. Check grounding per "Grounding"
CONFIGURATION PROBLEMS		
3	Confirm the accuracy of the configuration parameters. Errors here are easy to fix, yet they are often overlooked.	
4	Turn on the supply pressure.	
5	Place the ValvePAC in Manual mode (using hand-held commands, the pushbuttons - see "Operation," or the optional ValVue software).	

TABLE 5-6 Trouble Shooting Checklist (Continued)

PERFORMANCE PROBLEMS		
6	With the unit still in Manual mode, confirm that the valve is in the set position by moving it to the fully open and fully closed positions (This step requires ValVue software. Skip if it is unavailable.)	
	IF	THEN
	The valve correctly performs the open/close command in manual mode.	Continue to step 7.
	The valve does not perform the open/close command correctly.	Review the following conditions: 1. Confirm that the supply pressure is set properly and that it is connected to the ValvePAC. 2. See "Calibration Procedures (using pushbuttons)" to check and adjust the bias. 3. If the valve is stuck, it may need to be cleaned. 4. If "FAILSAFE" appears on the display, review "Fail-Safe Display." 4. The evaluation of a faulty EPC or faulty connection to the EPC is beyond the intent of this procedure and the ValvePAC unit must be returned to the factory for repair or replacement.
7	Set the "STOPS" as described in "Calibration."	
	IF	THEN
	The procedure runs successfully,	Continue to step 8.
	"FAILSAFE" is displayed when the valve hits either one of its stops.	The position sensor (potentiometer) must be reset. Refer to "Fail-Safe Display."
8	Perform the automatic "TUNE" operation as described in "Calibration."	
	IF	THEN
	The procedure runs successfully,	Continue to step 9.
	"BIAS" is displayed for over 5 minutes while the procedure continues to run.	The bias needs to be adjusted. Stop the Auto Tune procedure and mechanically adjust the bias by changing the bias spring's compression. Follow the procedure in "Calibration Procedures (using pushbuttons)."
	The procedure runs to completion, but the Damping Coefficient is non-zero.	Refer to "Damping Coefficient".
9	While still in Manual mode, use the pushbuttons or the hand-held communicator to order the ValvePAC to move the valve to the 50% position.	
	IF	THEN
	The valve performs the command correctly.	Continue with step 10.

TABLE 5-6 Trouble Shooting Checklist (Continued)

<table>
<tr><td></td><td>The valve does not perform the command in the manual mode correctly.</td><td>Review the following conditions:
1. Check for improper limit stops (repeat the Set Limit Stops commands and re-test).
2. Check the position sensor for misalignment or malfunction.
3. The bias may be out of range. If available, use ValVue's "Check 760D" command to investigate. Otherwise, use the push-buttons to reset the bias "Calibration Procedures (using pushbuttons)."
4. The spool valve may need to be cleaned.</td></tr>
<tr><td></td><td>The valve oscillates.</td><td>Review the following conditions:
1. Check for improper tuning. Then either perform another AutoTune or input manual values and re-test.
2. Check the grounding and eliminate noise due to improper grounding.
3. Check the linkage between the position sensor and the valve for excessive play.
4. Check for spool malfunction.
5. Check for excessive friction in the valve packing.</td></tr>
<tr><td></td><td colspan="2">Identifying Limit Cycling:
Tight valve stem packing, an undersized actuator, or foreign material in the spool valve can contribute to limit cycling. Identify limit cycling conditions by a process of elimination (e.g., not noise, not oscillation). Install valve packing only tight enough to prevent leakage. Evaluate the valve packing by running the ValVue diagnostic program (if available) to determine if the friction is consistent with the type of valve. If you determine that the spool valve creates limit cycling, clean or replace the valve.</td></tr>
<tr><td>10</td><td colspan="2">While still in Manual mode, use the pushbuttons or the hand-held communicator to order the ValvePAC to move the valve to the 95% position.</td></tr>
<tr><td></td><td>IF</td><td>THEN</td></tr>
<tr><td></td><td>The valve performs the command in the manual mode correctly.</td><td>The ValvePAC and valve systems are performing properly.</td></tr>
<tr><td></td><td>The valve does not perform the command in the manual mode correctly.</td><td>Review the following conditions:
1. Check the power supply to determine insufficient voltage.
2. Check the air supply to determine if an insufficient pressure condition exists.</td></tr>
</table>

■

6.0 MAINTENANCE

The Controller requires no routine maintenance. It is highly recommended that quality instrument air be used as described in "Instrument Air Requirements."

The filter screens may require periodic cleaning. The frequency of their cleaning is conditional depending on the quality of instrument air used.

It is also recommended that the end user perform periodic functionality tests in accordance with the critical nature of the application.

6.1 FILTER SCREENS

Filter screens are located in the V1, V2, and supply ports. Refer to the Parts List at the back of this Instruction.

1. Turn air supply off.
2. Remove a screen with a scribe by carefully pulling on and around the edge of a screen.
3. Insert a new screen until it bottoms using an object, such as the eraser end of a pencil, that will not cause damage.

6.2 SPARE AND REPLACEMENT PARTS

Refer to the parts list at the back of this Instruction for a list of replacement parts and an exploded view. Spare and replacement parts are available from any of the addresses in the warranty statement. Refer to the parts list for recommended on-hand spare parts.

6.3 RETURN FOR REPAIR

To Return for Repair

Call the Service Department at +1 215 646 7400, ext. 4RMA (4762) weekdays between 8:00 a.m. and 4:45 p.m. Eastern Time to obtain an RMA (Return Material Authorization) number. Mark the RMA number prominently on the outside of the shipment.

When calling for an RMA number, provide the reason for the return. If returning equipment for repair, failure information (e.g., error code, failure symptom, installation environment) will be requested. A purchase order number will also be needed.

Material Safety Data Sheet

A Material Safety Data Sheet (MSDS) must be included with each item being returned that was stored or used where hazardous materials were present.

Packaging

Package assembly in original shipping materials. Otherwise, package it for safe shipment or contact the factory for shipping recommendations.

■

7.0 MODEL DESIGNATION

Each ValvePAC has a nameplate identifying the model number, bill of material, and input range. The following decodes the model number on the label located inside the cover. Before installing or servicing a Controller, review the model number information.

Basic Model No.
760 Digital Valve Controller

Device Type
- D1 Valve Controller (Positioner)
- D2 Valve Controller (Positioner) with optional process controller function

Action
- 1 1/2 to 4 inch stroke lever
- 2 2 to 6 inch stroke lever
- 3 1/4 turn - 1/2 inch square shaft
- 4 1/2 to 2 inch stroke lever
- 5 1/4 turn - NAMUR style shaft end

Enclosure (with 3/4 inch NPT conduit connection)
- A Standard
- B With 90° beacon indicator
- C With 60° flat indicator (rising stem applications)
- D With 90° flat indicator (1/4 turn rotary applications)

Flow Capacity
- A Standard capacity spool valve assembly (Cv = 0.3)

Environmental Construction Options
- A Standard temperature (-40 to 185° F)

Gauges
- G Gauges (set of 2) included

Type of Actuator
- 1 Single acting, mechanical, direct action
- 3 Double acting

Display
- N Not required
- D With 2-line, 7 digit, alphanumeric display

Reserved for Future Use
- N

Design Level
- A

Electrical Certification (refer to Specifications)
- 7 FM/CSA/CENELEC/SCS

760 D1 5 A A A G 3 N N A 7 Sample Model No.

7.1 OPTIONS

Options are installed either in the field by the user or at the factory. The following options are available:

TABLE 7-1 Options

TYPE	DESCRIPTION
Flat Indicator	Flat lens and indicator provide a rough visual indication of valve position.
Hi-Vis™ Beacon Indicator	Beacon lens and indicator provide a rough visual indication of valve position; used only on rotary actuators.
Local Display	Pushbuttons and digital display can be used for configuration.
Process Controller	ValvePAC can be configured as a PID process controller.

■

8.0 SPECIFICATIONS

TABLE 8-1 Operating Limits

PARAMETER	REFERENCE	OPERATIVE LIMITS	STORAGE AND TRANSPORT
Temperature [1]	25° C	-40 to +80° C	-45 to +85° C
Relative Humidity [2]	10 to 55%	5 to 100%	0 to 100
Shock	1 G	Tested per ISA-S75.13-1996	
Vibration	1 G	Tested per ISA-S75.13-1996	
Electromagnetic compliance [3]	Complies with 89/336/EEC, EMC directive		
Terminal Compliance Voltage	12 V		

NOTES:
1. External surface temperature
2. May be condensing
3. Compatible with CE Mark requirements. Applies to 4-20 mA input. Physical protection is provided for other terminals. Refer to EN50081-2 and EN 50082-2.

TABLE 8-2 Performance Specifications

TYPE	DESCRIPTION
Inputs	4-20 mA with HART communication protocol.
Accuracy	0.5% of span
Conformity (independent based)	0.2% of span
Hysteresis	0.2% of span
Deadband	Adjustable from 0 to 1% of span
Operating temperature	-40 to +80°C
Air supply pressure	100 psi max. (7 bar max.)
Supply pressure effect	Negligible
Flow Capacity	8.5 scfm @ 60 psi (Cv = 0.26)
Software characterizations	Linear, equal percentage 50, equal percentage 30, quick opening, and customer-defined
Display	Liquid crystal, optional
Electromagnetic compatibility	EN 50081-2 and EN 50082-2
Electromagnetic fields	80 MHz - 1 GHz; 10 Volts/meter; 80% AM, 1 kHz
Electrostatic discharge	4 kV contacting; 8 kV non-contacting
Fast transient burst	2 kV @ 5 kHz
Enclosure rating	IP 65, Type 4X

TABLE 8-3 Physical Specifications

TYPE	DESCRIPTION
Air Supply and Output Connections	1/4 inch NPT internal
Electrical Connections	3/4 inch NPT conduit
Weight	6.5 lb.
Finish	Trimite epoxy-polyester powder coating Film thickness: 2 to 5 mils. cured Hardness: Pencil H to 3H per ASTM – D–3363–74 Direct/Reverse impact: Up to 160 inch pounds per ASTM – D–2794–84

TABLE 8-4 Electrical Safety Design Specifications

AGENCY	SERVICE	APPLICABLE CLASS
FM (Factory Mutual) Approval	Intrinsically Safe	Class I, Division 1, Groups A, B, C, and D Class II, Division 1, Groups E, F, and G Class III, Division 1
	Non-incendive	Class I, Division 2, Groups A, B, C, and D
	Suitable for	Class II, Division 2, Groups F and G; Class III, Division 2
CSA (Canadian Standards Association) Certification	Intrinsically Safe	Class I, Division 1, Groups A, B, C, and D Class II, Division 1, Groups E, F, and G Class III, Division 1
	Suitable for	Class I, Division 2, Groups A, B, C, and D Class II, Division 2, Groups E, F, and G Class III, Division 1
CENELEC Certification	Intrinsically Safe	EEx ia IIC T4
SCS (Sira Certification Services)		Ex N IIC T5. Suitable for Zone 2
Enclosure Rating		Type 4X, in accordance with NEMA Std. 250 Type IP 65, in accordance with IEC Std. 529

NOTE

The ValvePAC unit is designed to meet the electrical safety specifications listed here. Consult factory for current status of agency approvals.

■

WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate, and all repairs made by it, to be free from defects in material and workmanship under normal use and service. If any part of the equipment herein described, and sold by the Company, proves to be defective in material or workmanship and if such part is within twelve months from date of shipment from the Company's factory, returned to such factory, transportation charges prepaid, and if the same is found by the Company to be defective in material or workmanship, it will be replaced or repaired, free of charge, f.o.b. Company's factory. The Company assumes no liability for the consequence of its use or misuse by Purchaser, his employees or others. A defect in the meaning of this warranty in any part of said equipment shall not, when such part is capable of being renewed, repaired or replaced, operate to condemn such equipment. This warranty is expressly in lieu of all other warranties, guaranties, obligations, or liabilities, expressed or implied by the Company or its representatives. All statutory or implied warranties other than title are hereby expressly negated and excluded.

Warranty repair or replacement requires the equipment to be returned to one of the following addresses:

Equipment manufactured or sold by MOORE PRODUCTS CO.

MOORE PRODUCTS CO.
Sumneytown Pike
Spring House, PA 19477 U.S.A.
Tel: +1 215 646 7400
Fax: +1 215 283 6340

Equipment manufactured or sold by MOORE PRODUCTS CO. (Canada) Inc.

MOORE INSTRUMENT LTD/LTEE
P.O. Box 370
Brampton, Ontario L6V 2L3, Canada
Tel: +1 905 457 9638
Fax: + 1 905 457 4182

Equipment manufactured or sold by MOORE PRODUCTS CO. (UK) LTD.

MOORE PRODUCTS CO. (UK) LTD
Copse Road,
Lufton Industrial Estate
Yeovil, Somerset BA22 8RN, England
Tel: +44 1935 706262
Fax: +44 1935 706969

Warranty will be null and void if repair is attempted without authorization by a member of the Moore Products Co. Service Department.

DECLARATION OF CONFORMITY

according to EN 45014

We

Moore Products Co.
Sumneytown Pike, Spring House, PA 19477

declare under our sole responsibility that the product,

Model 760D, Valve Positioner with any factory installed options and in any configuration available from the factory

to which this declaration relates is in conformity with the following standards or other normative documents

EMC: EN50081-2 Emissions
EN50082-1 and EN50082-2 Immunity

following the provisions of the EMC directive

Spring House, PA U. S. A.

Date: 12/16/97

John C. Grebe
Manager
Research and Development

GROUP II

1 **CERTIFICATE OF CONFORMITY - Apparatus**

2 Certificate No. Sira Ex 98D2108

3 This Certificate is issued for the electrical apparatus:

Series 760D Valve Controller

4a Manufactured by:

Moore Products Company
Spring House
PA 19477-0900
USA

4b Submitted for certification by:

The Manufacturer

5 This electrical apparatus and any acceptable variation thereto is specified in the schedule to this Certificate and the documents therein referred to.

6 Sira Certification Service being an Approved Certification Body in accordance with Article 14 of Directive 76/117/EEC of the Council of the European Communities of 18 December 1975 certifies that the apparatus has been found to comply with the following harmonised European Standards:

EN 50 014:1977 (amendments A1 to A5)
EN 50 020:1977 (amendments A1 to A5)

The assessment and test results are recorded in Sira Test Report R52A4841A.

7 The apparatus marking shall include the code:

EEx ia IIC T4 (T_a = -40°C to +80°C)

Dated 12 October 1998

M D Shearman
Certification Manager

File No. 52A4841
C. index : 12

This certificate and its schedules may only be reproduced in its entirety and without change

Sira Certification Service
South Hill, Chislehurst, Kent, BR7 5EH, England
Tel: +44 (0)181 467 2636 Fax: +44 (0)181 295 1990
Email: certification@siracs.prestel.co.uk

GROUP II

CERTIFICATE OF CONFORMITY Sira Ex 98D2108 Dated 12 October 1998

8 The manufacturer of the electrical apparatus referred to in this Certificate has the responsibility to ensure that the apparatus conforms to the specification laid down in the Schedule to this Certificate and has satisfied the routine verifications and tests referred to therein.

9 This apparatus may be marked with the Distinctive Community Mark defined in Annex II of Commission Directive 84/47/EEC of 16 January 1984. This mark is reproduced on each page of this Certificate; it shall be affixed to the apparatus in such a way as to be visible, legible and durable.

The use of this apparatus will normally be the subject of National Legislation and/or Installation Codes.

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Sira Certification Service
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Email: certification@siracs.prestel.co.uk

SCHEDULE

CERTIFICATE OF CONFORMITY Sira Ex 98D2108 Dated 12 October 1998

APPARATUS

The Series 760D Valve Controller is designed to drive an actuator to position a valve in proportion to an input signal. The input signal can either be pneumatic or electric (4-20mA). The 760D can also receive feed back from a smart transmitter. A valve position indicator can be viewed through a window in the enclosure.

The apparatus comprises; a Masoneilan Dresser SVI Positioner and Controller, a low power solenoid valve, and a pressure transducer, all of which are mounted on a terminal board and are approved under Sira Certificate No: Ex 97D2020. An LCD display may be mounted on top of the SVI Controller. All of these component parts are housed within a metal enclosure which can be fitted with an optional transparent flat window or dome. External electrical connections are made to terminal blocks via a threaded entry which accommodates conduit or cable. A number of other threaded entries permit the pneumatic connections.

Electrical Parameters

Field connector, + and - (Power input)
U_i = 30V dc
I_i = 125mA
P_i = 0.9W
C_i = 2.2nF
L_i = 96µH

Field connector A, B, C (Controller link)
U_i = 30V dc
C_i = 0nF
L_i = 0µH

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SCHEDULE

CERTIFICATE OF CONFORMITY Sira Ex 98D2108 Dated 12 October 1998

DESCRIPTIVE DOCUMENTS

Drawing No:	Sheets	Rev	Date	Description
15032-7605	1 of 5	3	31 Jul 98	CERTIFICATION DWG. MODEL 760D
15032-7605	2 of 5	3	31 Jul 98	CERTIFICATION DWG. MODEL 760D
15032-7605	3 of 5	3	31 Jul 98	CERTIFICATION DWG. MODEL 760D
15032-7605	4 of 5	3	31 Jul 98	CERTIFICATION DWG. MODEL 760D
15032-7605	5 of 5	3	31 Jul 98	CERTIFICATION DWG. MODEL 760D
15177-7609	2	2	24 Sep 98	CERT DWG 760D SCS EEx ia

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Email: certification@siracs.prestel.co.uk

SCHEDULE

CERTIFICATE OF CONFORMITY Sira Ex 98D2108 Dated 12 October 1998

CONDITIONS OF CERTIFICATION

1 The use of the Sira Certification Service Mark is subject to the Regulations applicable to the holders of SCS certificates.

2 This certificate relates only to the apparatus specified herein as executed in the samples supplied for evaluation.

3 In affixing the Sira certificate number to the apparatus the manufacturer attests on its own responsibility that the apparatus conforms to the documents listed herein.

If the marked apparatus is found not to comply Sira Certification Service should be notified immediately at its office at South Hill, Chislehurst, Kent BR7 5EH, England.

4 The apparatus and that part of the manufacturer's quality management system controlling the production of the apparatus covered by this certificate shall be subject to periodic surveillance by Sira in accordance with the Regulations applicable to the holders of SCS certificates.

5 This certificate relies on the following previously certified products. When they are used as part of the Series 760 Valve Controller, they shall still be covered by their original certificate.

Masoneilan Dresser, SVI Positioner and Controller	SCS Ex 97D2020 Variation 1
Moore Products, Series 760 Valve Controller	SCS Ex 97D2141X and Ex 97Y4054X

SPECIAL CONDITIONS FOR SAFE USE *(denoted by 'X' after certificate No.)*

None

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Sira Certification Service
South Hill, Chislehurst, Kent, BR7 5EH, England
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Email: certification@sirace.prestel.co.uk

TOTAL P.06

A.0 MODEL 275 UNIVERSAL HART COMMUNICATOR

The Model 275 Universal HART Communicator is a handheld interface that provides a common communication link to Model 760D ValvePAC Valve Controllers and other HART-compatible instruments. Most of the functionality offered with the ValVue Software is also available with the HART Communicator, with the exception of Process Trend and Diagnostic plotting.

This appendix describes HART Communicator connections, liquid crystal display, keypad, and on-line and off-line menus. It also provides short overviews of some of the Communicator's functions. The Communicator is shown in Figure A-1. For information about the Communicator's battery pack, Memory Module, Data Pack, and maintenance procedures, refer to the manual supplied with the Communicator.

A.1 INTRODUCTION

From a wiring termination point, the HART Communicator interfaces with a ValvePAC Valve Controller or other HART device using a 4-20 mA loop, provided a minimum load resistance of 250Ω is present between the Communicator and the power supply. The Communicator uses the Bell 202 frequency-shift keying (FSK) technique of high-frequency digital signals imposed on a standard instrument current loop of 4-20 mA. Because no net energy is added to the loop, HART communication does not disturb the 4-20 mA signal. The Communicator can be used in hazardous and non-hazardous locations.

WARNING

Explosions can cause death or serious injury. Before connecting the HART Communicator in an explosive atmosphere, make sure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices. Refer to the Communicator nameplate and the manual supplied with the Communicator for certifications and approvals before connecting.

A.2 COMMUNICATOR CONNECTIONS

The Communicator can interface with an instrument from the control room, the instrument site, or any wiring termination point in the loop. Connections are made through loop connectors on the Communicator's connection panel (Figure A-1). The connection panel also may have a jack for the optional NiCad recharger, and it has a serial port for a future connection to a personal computer (PC).

To interface with an instrument or other HART device, connect the HART Communicator in parallel with the instrument or load resistor. The connections are nonpolar. For intrinsically safe FM and CSA wiring connections, see the manual supplied with the Communicator.

WARNING

Explosions can result in death or serious injury. Before making connections to the serial port or NiCad recharger jack in an explosive atmosphere, check the Communicator nameplate and the manual supplied with the Communicator for approvals.

Figure A-2 illustrates typical wiring connections between the HART Communicator and a loop with a ValvePAC Valve Controller or other HART-compatible device on a loop. The Communicator is quickly connected into an instrument loop.

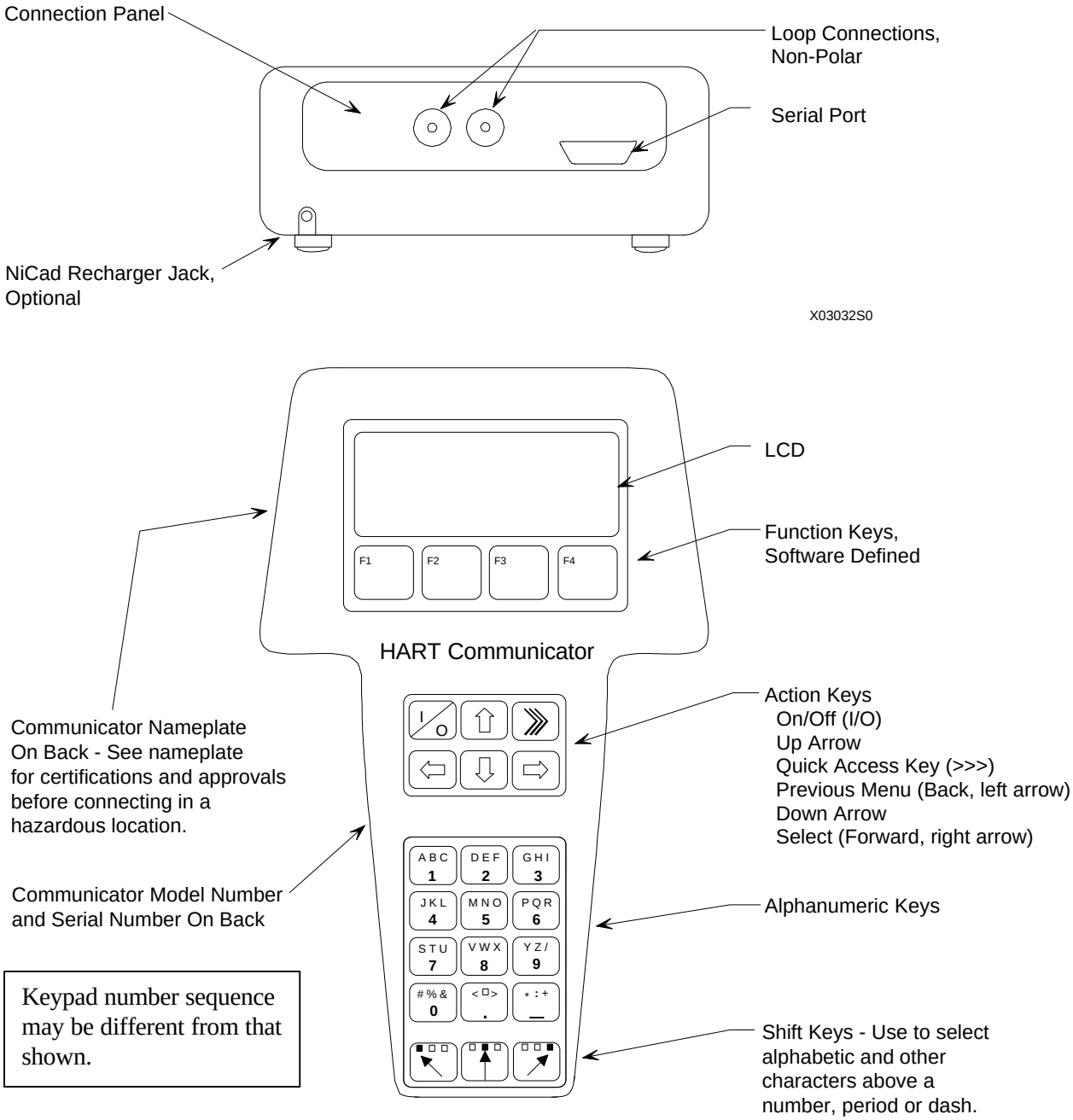
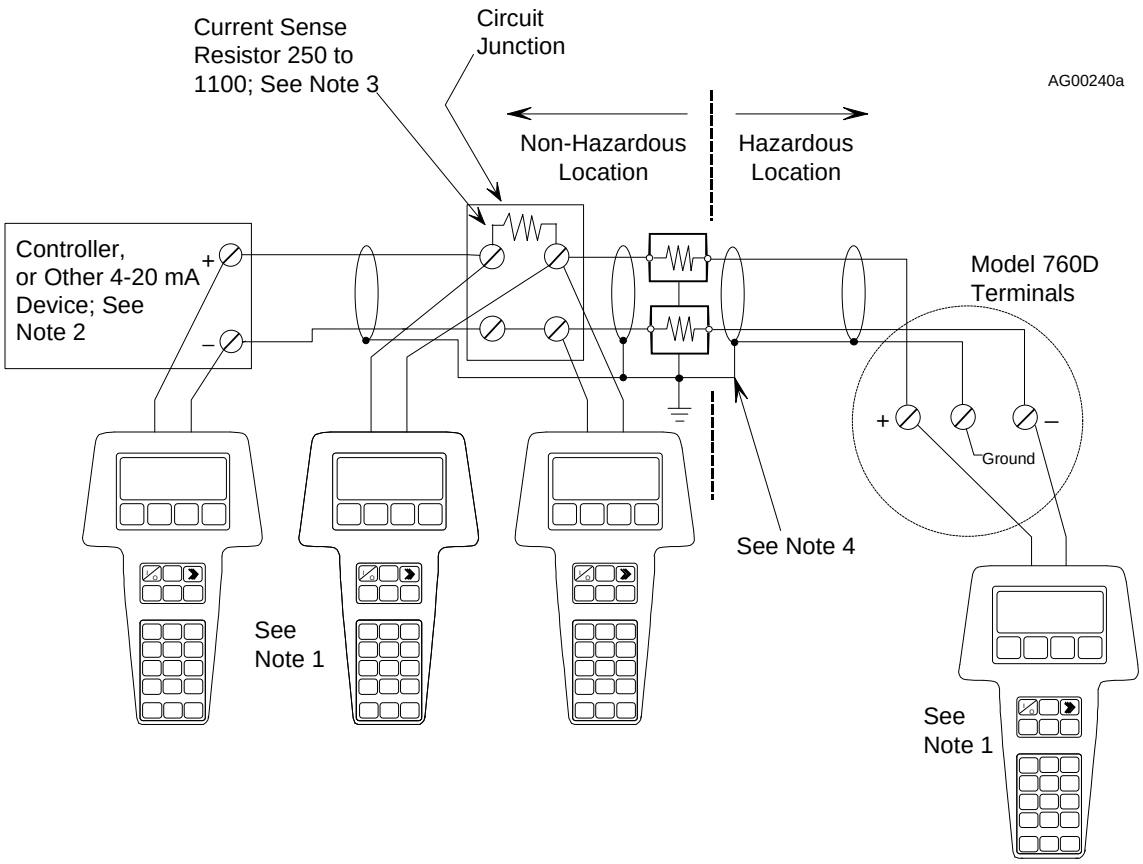

Connection Panel
Loop Connections, Non-Polar
Serial Port
NiCad Recharger Jack, Optional
X03032S0
LCD
Function Keys, Software Defined
F1
F2
F3
F4
HART Communicator
Communicator Nameplate On Back - See nameplate for certifications and approvals before connecting in a hazardous location.
Action Keys
On/Off (I/O)
Up Arrow
Quick Access Key (>>>)
Previous Menu (Back, left arrow)
Down Arrow
Select (Forward, right arrow)
Communicator Model Number and Serial Number On Back
Alphanumeric Keys
Keypad number sequence may be different from that shown.
Shift Keys - Use to select alphabetic and other characters above a number, period or dash.

FIGURE A-1 Model 275 Universal HART Communicator



Notes:

1. HART Communicator Connections:
   Non-hazardous location - Connect as shown above.
   Hazardous location - Refer to Communicator nameplate and the Manual supplied with the Communicator for certifications and approvals before connecting.

   The HART Communicator is a non-polar device.

2. The System Power Supply may be part of the host input device or a separate device.

3. Network resistance equals the sum of the barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.

4. Supply and return barriers shown. Interconnect all cable shields and ground only at the barriers.

FIGURE A-2 HART Communicator Connections to a Transmitter Loop

A 40" (1 m) cable with a dual banana plug on one end and two mini-grabber plugs on the other is provided. The dual banana plug is inserted into the top of the Communicator; the mini-grabber clips are connected to lugs on the ValvePAC Valve Controller's terminal board or to the loop's current sense resistance, usually at a receiving instrument (see Note below).

NOTE

The HART protocol requires a network (loop) resistance between 250Ω and 1100Ω to support communications.

A.3 CONTROLS OVERVIEW

As shown in Figure A-1, the front of the HART Communicator has five major functional areas: liquid crystal display (LCD), function keys, action keys, alphanumeric keys, and shift keys. The next five sections describe how each of these functional areas is used to enter commands and display data.

A.3.1 Liquid Crystal Display

The liquid crystal display (LCD) is an 8-line by 21-character display that provides communication between the user and a connected device. When the HART Communicator is connected to a ValvePAC Valve Controller or other HART-compatible device, the top line of the Online menu displays the model name of the device and its tag. A typical display is shown below:

```
Moore760D:VP100
**MANUAL MODE**      ↵
 1->valve pos    14.8%
 2 act press    -0.1 psi
 3 change pos <->
 4 MANUAL MODE MENU
 5 CONTROLLER
HELP |SAVE
```

The bottom line of each menu is reserved for dynamic labels for the software-defined function keys, F1-F4, which are found directly below the display. More information on software-defined function keys is given in the next section.

A.3.2 Software-Defined Function Keys

The four software-defined function keys (softkeys), located below the LCD and marked F1 through F4, are used to perform software functions as indicated by the dynamic labels. Pressing the function key immediately beneath a label activates the displayed function.

The label appearing above a function key indicates the function of that key for the current menu. For example, in menus providing access to on-line help, the HELP label appears above the F1 key. In menus providing access to the Online menu, the HOME label appears above the F3 key. Table A-1 lists these labels and describes what happens when each function key is pressed.

TABLE A-1 Function Keys with Their Labels and Actions Performed

F1	F2	F3	F4
HELP Access on-line help	ON/OFF activate or deactivate a bit-enumerated binary variable	ABORT terminate current task	OK Acknowledge information on the LCD
RETRY try to reestablish communication	DEL delete current character or Quick Access Key menu item	ESC leave a value unchanged	ENTER accept user-entered data
EXIT leave the current menu	SEND send configuration data to device	QUIT terminate session because of a communication error	EXIT leave the current menu
YES Answer to yes/no question	PGUP move up one help screen	PGDN move down one help screen	NO answer to yes/no question
ALL Include current Quick Access Key item on Quick Access Key menu for all devices	PREV go to previous message in a list of messages	NEXT go to next message in a list of messages	ONE include Quick Access Key item for one device
NEXT go to the next variable in off-line edit	SAVE save information to Communicator	HOME go the top menu in the device description	
FILTR Open customization menu to sort configurations	MARK toggle marked variable in configuration to be sent to a field device	BACK go back to the menu from which HOME was pressed	
	XPAND opens detailed configuration information	EDIT edit a variable value	
	CMPRS closes detailed configuration information	ADD add current item to Quick Access Key menu	

A.3.3 Action Keys

Directly beneath the LCD and software-defined function keys are six blue, white, and black action keys. Each has a specific function as described below:

ON/OFF KEY – Use to power-up the Communicator. When the Communicator is turned on, it automatically searches for a HART-compatible device on the 4-20 mA loop. If no device is found, the Communicator displays the Main menu:

```
HART Communicator
 1->Offline
 2 Online
 3 Frequency device
 4 Utility
```

If a HART-compatible device is found, the Communicator displays the Online menu:

```
Moore760D:VP100
**MANUAL MODE**      ↵
 1->valve pos    14.8%
 2 act press    -0.1 psi
 3 change pos <->
 4 MANUAL MODE MENU
 5 CONTROLLER
HELP |SAVE
```

UP ARROW KEY – Use to move the cursor up through a menu or list of options or to scroll through lists of available characters when editing fields that accept both alpha and numeric data.

DOWN ARROW KEY – Use to move the cursor through a menu or a list of options or to scroll through lists of available characters when editing fields that accept alpha and numeric data.

LEFT ARROW/PREVIOUS MENU KEY – Use to move the cursor to the left or back to the previous menu.

RIGHT ARROW/SELECT KEY – Use to move the cursor to the right or to select a menu option.

QUICK ACCESS KEY (HOT KEY) – When the Communicator is on and connected to a HART-compatible device, pressing the Quick Access Key instantly displays the Quick Access Key menu of user-defined options. When the Communicator is off and the Quick Access Key is pressed, the Communicator automatically powers-up and displays the Quick Access Key menu.

See Section A.6 for more information on using the Quick Access Key.

IMPORTANT

When performing certain operations, the message "OFF KEY DISABLED" indicates that the Communicator cannot be turned off. This feature helps prevent accidental shutoff of the Communicator while the output of a device is fixed or a device variable is being edited.

A.3.4 Alphanumeric and Shift Keys

The alphanumeric keys perform two functions: (1) rapid selection of menu options and (2) data entry. The shift keys located below the alphanumeric keys on the keypad are used during data entry to select from among the characters available above each number.

A.3.4.1 Rapid Selection of Menu Options

From any menu, use the keypad to select available options in two ways. First, use the UP or DOWN arrow keys, followed by the RIGHT ARROW/SELECT key, to access available options displayed on the LCD. As an alternative, use the rapid select feature. Simply press the number on the alphanumeric keypad that corresponds to the desired menu option. For example, to quickly access the Utility menu from the Main menu, simply press "4" on the keypad.

A.3.4.2 Data Entry

Some menus require data entry. Use the alphanumeric and shift keys to enter all alphanumeric information into the HART Communicator. Pressing an alphanumeric key alone while editing causes the large character in the center of the key (number 0-9, decimal point, or dash) to be entered.

Pressing and releasing a shift key activates shift and causes the appropriate arrow icon (, , or) to appear in the upper right-hand corner of the LCD. When shift is activated, the indicated alpha characters or symbols are entered when the keypad is used.

Example

To enter a number, such as "7," simply press the number key.

To enter one of the small characters appearing above the large numeral (i.e., a letter, space, or mathematical symbol), first press and release the corresponding shift key at the bottom of the keypad, then press the desired alphanumeric key. To enter the letter "E," press and release the middle shift key, then press the number "8" key.

To deactivate a shift key without entering a letter, space, or mathematical symbol, simply press that shift key again.

A.4 GETTING TO KNOW THE COMMUNICATOR

The HART Communicator operates in either of two modes: on-line or off-line. Use off-line operation to create or edit a configuration that can then be downloaded to a HART device, such as the ValvePAC Valve Controller. Use on-line operation to download a configuration to a HART device, upload a configuration, edit HART device operating parameters, and monitor process values.

For off-line operation, the Communicator need not be connected to a HART device. On-line operation requires a connection to a HART device.

The menu that appears first when the Communicator is turned on depends on whether it is connected to a loop. If the Communicator is powered-up without being connected to a loop, the first menu displayed is the Main menu. If the Communicator is powered-up while connected to a loop, the first menu displayed is the Online menu. To work off-line when connected to the loop, access the Main menu from the Online menu by pressing the LEFT ARROW/PREVIOUS MENU key.

A.4.1 Display Icons

Several symbols (icons) appear on the LCD to show the state of the Communicator and provide visible response to actions of the user. Figure A-3 shows the display icons and how they relate to keypad functions.

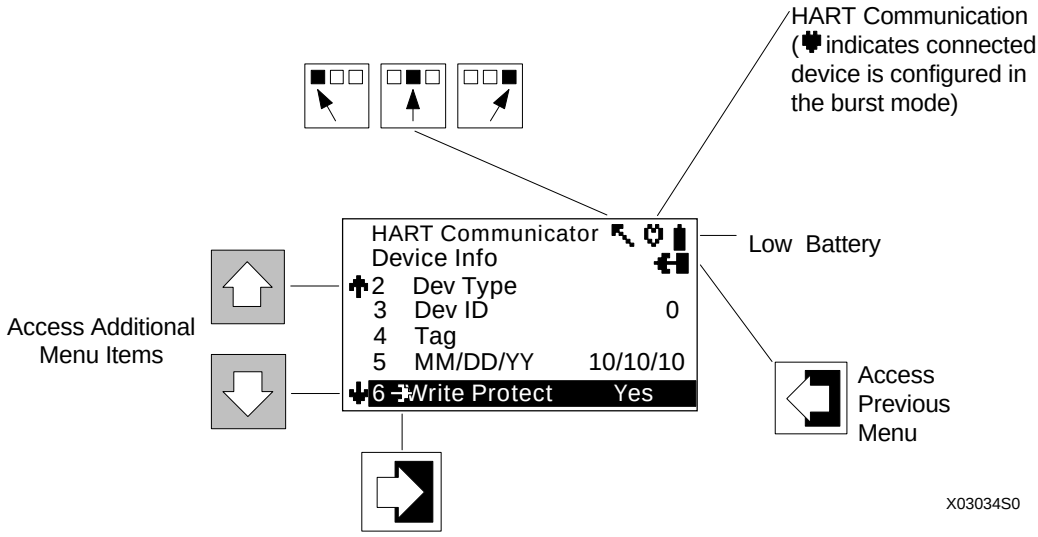


FIGURE A-3 Communicator Display Icons

A.4.2 Menu Structure

The HART Communicator uses a hierarchical menu structure. That is, high-level menus are accessed first, and they provide access to lower-level menus. This structure groups related functions together and minimizes the number of options displayed at once.

To learn how the menu structure works, perform the following actions:

1. With the Communicator off-line (not attached to any devices), press the ON/OFF key to turn the Communicator on. After running a self diagnostic, it will display the Main menu, with the cursor (->) positioned at "1 Offline."
2. Access the Utility menu by pressing the DOWN arrow key three times, then pressing the RIGHT ARROW/SELECT key. The display changes to show the Utility menu.
3. Access the Configure Communicator menu from the Utility menu by pressing the RIGHT ARROW/SELECT key. The display changes to show the Configure Communicator menu.

4. Access the Contrast menu by pressing the DOWN arrow once, then pressing the RIGHT ARROW/SELECT key. The display shows a message explaining how to adjust the LCD contrast.
5. Press ESC (F3) to return to the Configure Communicator menu.
6. Press the LEFT ARROW/PREVIOUS MENU key two times to return to the Main menu.
7. Press the ON/OFF key to turn the Communicator off.

A.4.3 Reviewing Installed Devices

For the HART Communicator to recognize a HART-compatible device, it must have a description for that device installed. The HART Communicator is supplied from the factory with a description for the Moore Series 760D ValvePAC Valve Controller and other HART-compatible devices from leading manufacturers. In addition, it contains a generic device description, which allows limited access to most HART devices when no device description for that specific device exists in the Communicator.

To review the currently installed devices on the Communicator, use the following steps:

1. Turn on the Communicator (off-line) to display the Main Menu.
2. From the Main menu, press “4” on the keypad for quick access to the Utility Menu.
3. From the Utility menu, press “5” on the keypad to access the simulation mode. The LCD shows the Manufacturer menu, which contains a list of manufacturers whose device descriptions are installed in the Communicator.
4. Press the DOWN arrow until Moore Products appears. Press the RIGHT ARROW/SELECT key to reveal the Model menu, which lists the Moore Products Co. devices currently installed in the Communicator (see Table A-2).
5. To end the review of devices, press the LEFT ARROW/PREVIOUS MENU key three times.
6. Turn off the Communicator or proceed to the next section.

TABLE A-2 Moore Device Descriptions

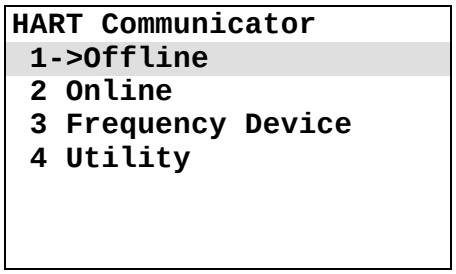
MODEL	FIELD DEVICE REVISION	DESCRIPTION	APPROXIMATE VINTAGE[1]
340B	Dev V1, DD V1	340 Transmitter-Controllers (pushbutton design)	8/90 - 8/96, Model #s 340__B…
340A	Dev V1, DD V1	340 Transmitter (pushbutton design)	8/90 - 8/94, Model #s 340__A…
344	Dev V1, DD V1	344 Transmitter-Controller	8/90 - 8/94 Model #s 344…
	Dev V2, DD V1	344 Transmitter-Controller	8/90 - Present, Model #s 344…
341 Type 5	Dev V1, DD V1	341 Transmitter	8/94 - Present, Model #s 341…
340A Type 6	Dev V1, DD V1	340 Transmitter (pushbutton design)	8/94 - 8/96, Model #s 340__A…
	Dev V2, DD V1	340 Transmitter (magnetic switch design)	Present, Model #s 340__B…
340S	Dev V1, DD V1	340 Steameter	
3403	Dev V1, DD V1	343 TemperatureTransmitter	
345	Dev V1, DD V1	345 Critical Transmitter	9/98-Present
760D	Dev V2, DD V1	Series 760D ValvePAC Valve Controller	9/98-Present

Note

[1]Always verify the Model and Field Device Revision for the device at hand using the Quick Access Key\Status\Model command of the Model 275 HART Communicator.

A.5 MAIN MENU

When the Communicator is not connected to a device, the first menu to appear after powering up and Self Test is the Main menu (at right). If the Communicator is turned on while connected to a device, access the Main menu by pressing the LEFT ARROW/PREVIOUS MENU key. Depending on which submenu of the on-line series is displayed, it may be necessary to press the LEFT ARROW/PREVIOUS MENU key more than once. Alternatively, press HOME (F3) to display the Online menu, followed by the LEFT ARROW/PREVIOUS MENU key to display the Main menu.



From the Main menu, access additional menus by moving the cursor to them with the UP or DOWN arrow keys, followed by pressing the RIGHT ARROW/SELECT key, or simply by pressing the appropriate number (1-4) on the alphanumeric keypad.

A.5.1 Offline Menu

The Offline menu provides access to two other menus: New Configuration and Saved Configuration. These two configuration menus can be used without connecting to a HART-compatible device, but it is not possible to send saved data to a device if no device is connected.

From the Main menu, press "1" on the keypad or the RIGHT ARROW/SELECT key to access the Offline menu. The complete menu tree for the Offline Menu is shown in Figure A-4.

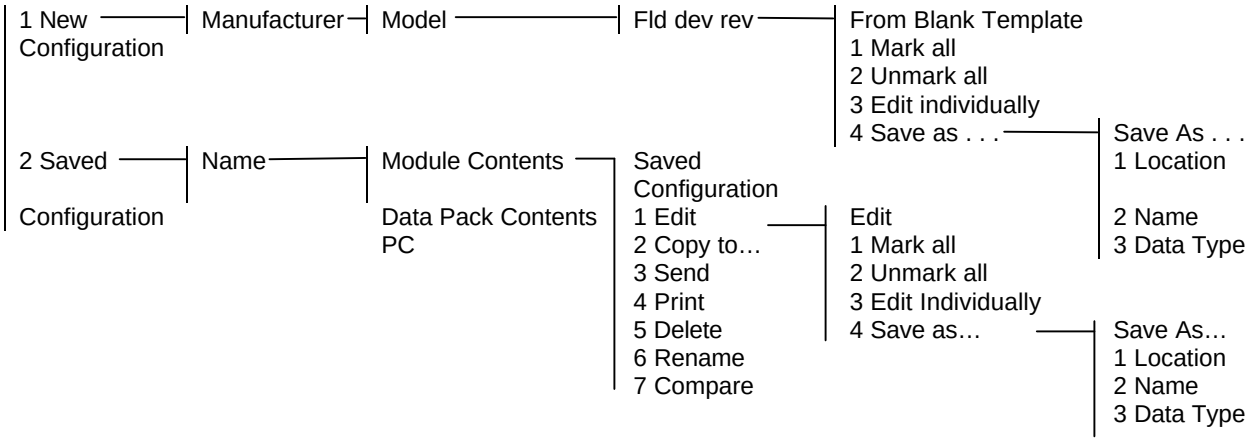
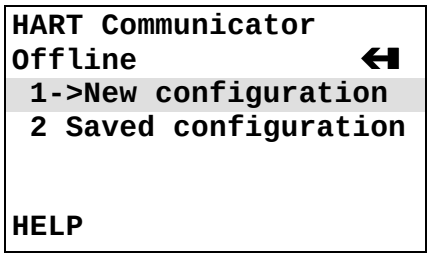


FIGURE A-4 Offline Menu Tree

A.5.1.1 New Configuration

This option is used to compile a custom set of device configuration data for downloading later to one or more HART-compatible devices. Downloading the same data to multiple devices ensures that they all store identical configuration data.

Use the following steps to compile off-line, new device configuration data:



1. From the Main menu, press "1" to access the Offline menu.
2. Press "1" to enter a new configuration. The Manufacturer menu appears.
3. Choose a manufacturer by scrolling to the manufacturer name with the DOWN arrow, then pressing RIGHT ARROW/SELECT. The Model menu appears.
4. From the Model menu, choose a device by scrolling through the list, then pressing RIGHT ARROW/SELECT. The Field Device Revision (Fld dev rev) menu appears.

   The Field Device Revision menu contains the currently installed software revisions for the field device and device descriptions (DD) for the model selected from the Model menu.

Select the software revision (RIGHT ARROW/SELECT or number) to access the Blank Template menu (at right). To discover the software revision for a particular device, connect the Communicator to the device and follow instructions given in the device manual.

```
Unnamed
From Blank Template  ↵
 1->Mark all
 2 Unmark all
 3 Edit individually
 4 Save as...

HELP |SAVE
```

5. With the Blank Template menu displayed, choose from the options available, as follows:

   Mark All – Flag all configurable variables before sending them to a HART-compatible device.

   Unmark All – Remove the flags from all configurable variables in the configuration. Unmarked configuration variables cannot be sent to a connected HART-compatible device.

   Edit Individually – Open the Edit individually menu (at right).

```
Unnamed
Edit individually
  Tag
   ********


Not marked to send
NEXT |MARK |EDIT |EXIT
```

   Example

   Use the Edit individually menu to change a configuration parameter. For example, to change the Tag, press the EDIT function key (F3) to display the Tag (bottom right).

```
Unnamed
Tag
 ********
 ********



HELP | DEL | ESC |ENTER
```

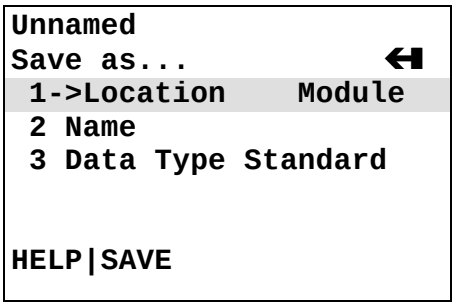
   With the Tag menu displayed, use the Shift Keys and Alphanumeric Keys to type in a new Tag, then press the ENTER function key (F4). Or, to leave the Tag menu without making any changes, press the ESC function key (F3) to return to the Edit individually menu. From the Edit individually menu, use EXIT to go back to the Blank Template menu.

   Save As. . .
   Selecting the Save As option allows a new configuration to be saved to either the Memory Module or the Data Pack. The Memory Module holds up to 10 typical configurations, and contains the operating system software and device application software in non-volatile memory. The Data Pack stores up to 100 typical configurations in nonvolatile, removable memory.

   Example

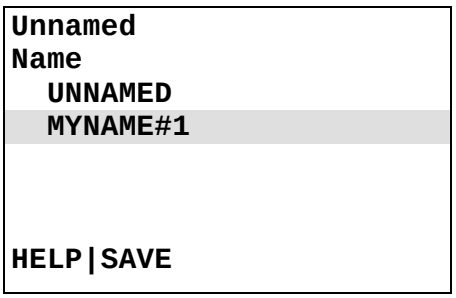
   From the Offline menu, choose 1 New configuration. This displays the Manufacturer menu. Choose a device, then choose a model from the Model menu. Choose a software revision from the Fld dev rev menu.

The Communicator creates a configuration and displays the Blank Template menu. Choose Save as... to display the Save as... menu (at right). With the Location highlighted, press the SAVE (F2) function key to save the configuration.

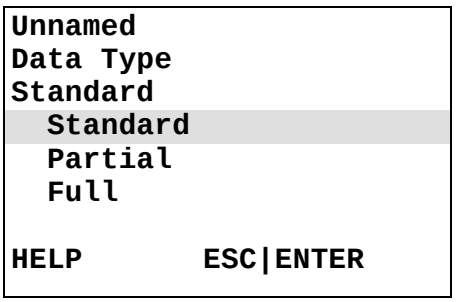


If the location highlighted is the Module, but the configuration is to be stored in the Data Pack, or vice versa, press the RIGHT ARROW/SELECT key to display the Location menu. Choose either Module or Data Pack by pressing ENTER (F4). This displays the Save as... menu again. Press SAVE (F2) to save the configuration in the desired location.

The Save As... menu also is used to enter or edit the configuration Name and Data Type. To name a configuration, simply choose option 2, then use the keypad with shift keys to enter the name as shown at right.



When the Save As... menu is displayed, one of the Data Type options – Standard, Partial, or Full – will be shown. To change the option, move the cursor to the Data Type _____ line of the Save As... menu and press the RIGHT ARROW/SELECT key to display the Data Type menu (below right).

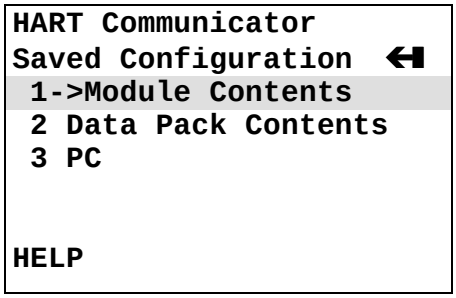


Data Type Standard refers to all user-editable variables in a device configuration. Data Type Partial refers to only the marked editable variables. Data Type Full refers to a all device variables, whether user-editable or not. In general, it is best to save as Data Type Standard. Saving as Data Type Full preserves a complete configuration for future reference.

When all changes have been made, save the new configuration to either the Memory Module or the Data Pack and return to the Offline menu.

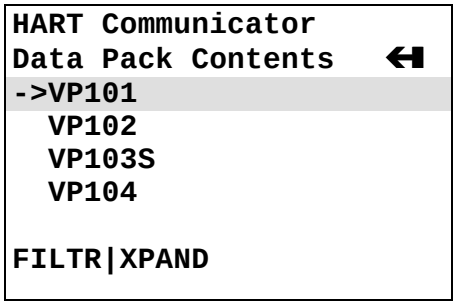
A.5.1.2 Saved Configuration

The second option on the Offline menu is the Saved Configuration menu, which permits access to previously stored configuration data.



1. Press “2” from the Offline Menu to display the Saved Configuration menu (at right).
2. Select either Module Contents or Data Pack Contents to open stored configurations. Both storage locations list all saved configurations by assigned Tag. See XPAND (below) for more configuration identification details. (**Note:** The PC option shown on the menu is not operational with firmware release 2.2.)

The Module Contents menu, which lists the configurations currently stored in the Memory Module, is shown at right. The Data Pack menu is similar. Both give the user several options for handling and viewing configuration data, as explained below.



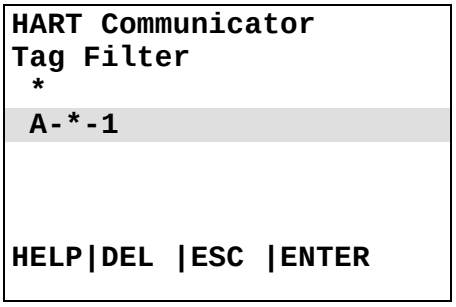
FILTR

The FILTR function key (F1) opens a menu that provides both Sort and Filter options. These options select only the chosen configurations from all those stored. This is particularly valuable for the Data Pack, which stores up to 100 configurations.

Sort allows unique device configurations to be grouped and displayed by Tag, Descriptor, or user-assigned Name.

Filter allows configurations to be grouped and displayed according to certain characters within the chosen device identifier (Tag, Descriptor, or Name). It is useful for selecting all the tags from a certain area of the process or plant.

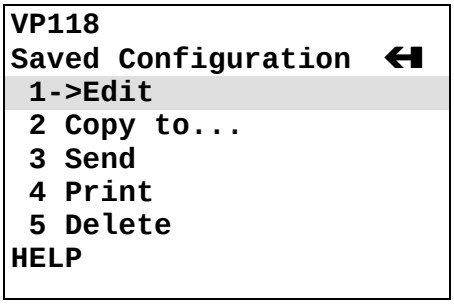
When setting up a Filter (see display at right), two wildcard characters, the period (.) and the asterisk (*) are used. The period replaces a single character of any value. The asterisk replaces one or more alphanumeric characters of any value.



For example, if A-*-.1 is entered as the filter, the configurations displayed will be all those with device tags starting with A-, followed by any combination of characters (e.g., XYZ, S2, 3R) followed by a dash, followed by any single character (e.g., 1, D, M), and ending with a 1. The tags A-M1-B1, A-N2-Z1, or A-SF-X1 would display, whereas the tags BA53, PT101, or ATT48 would not display.

XPAND

The XPAND function key allows a user to view the Tag, Descriptor, and Name for the configuration being edited or viewed. Selecting Compress restores the previous compressed display, which shows only the current Tag, Descriptor, or Name.



1. With the Module Contents or Data Pack Contents menu displayed, press the RIGHT ARROW/SELECT key to open the Saved Configuration menu for a device that was highlighted (at right).

Edit – displays the Edit menu, providing the same functions as described under "Edit individually" in Section A.5.1.1.
When editing off-line, only stored data may be edited. Moreover, data stored as a Partial configuration must be converted to a Standard configuration, then saved, prior to editing.

Copy To... – specifies the storage location for a copy of the configuration. Copy To... also provides a way to change the configuration name.

Send – sends a saved configuration to a connected device.

Print – not implemented with firmware release 2.2.

Delete – removes a saved configuration from memory. A confirmation message appears. Press Yes or No to complete the function.

Rename – provides access to the configuration name editing menu. After making name changes, enter and save the data to return to the previous storage location menu.

Compare – compares a selected device configuration from a stored location with other device configurations. The HART Communicator can compare device types, variables, marked lists, and other configuration parameters. Messages appear indicating if the configurations compared are the same or different.

A.5.2 Online Menu

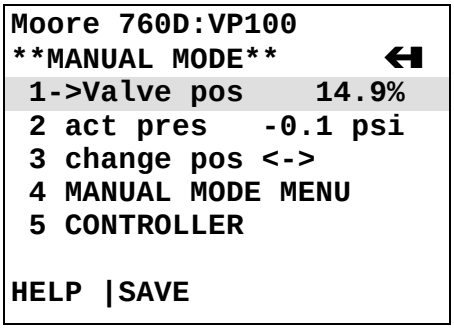
The Online menu permits a ValvePAC Valve Controller to be tested and configured while it is operating. Extensive options available through the Online menu are shown in Figures A-5 and A-5A through E. The Online menu is displayed immediately if a device description for the connected device exists in the Communicator. If not, the Generic Online menu is displayed (see Figure A-6).

NOTE

The ValvePAC Valve Controller stores fault messages in memory to record occurrences such as position errors or resets. These usually occur if the unit has experienced a power interruption, or an interruption in supply pressure. The memory location is referred to as "Status." When a HART Communicator is connected to a ValvePAC Valve Controller that has information stored in Status, the Communicator displays a diagnostic message stating that the "Field device has Status available. To stop this message from being displayed every few minutes it is necessary to move down through the menus to EXAMINE and CLEAR STATUS (see Figures A-5 and A-5D).

Main Menu

From the Main menu, with a HART-compatible device connected, press "2" to access the Online menu (at right). The Online menu displays the name of the device at the top of the LCD, if it is a supported device. If a device description for the connected device is not present in the Communicator, contact the manufacturer of the device.



When no device description is found, the Communicator provides a generic interface, which enables users to perform functions common to all HART-compatible devices. ValvePAC Valve Controller-specific menu options are described in detail later.

Generic Menu

The Generic Online menu (at right) is the first menu in the generic interface. It displays critical, up-to-date device information. Configuration parameters for the connected device may be accessed using the Device setup option. Figure A-6 shows the complete Generic Online menu tree.

```
1151:GENERIC          ♥
Online                ↵
 1->Device setup
 2 PV     50.0000 inH2O
 3 AO        12.000 mA
 4 LRV    0.0000 in H2O
 5 URV  100.0000 in H2O
     SAVE
```

From the Online menu, use the options below to change device configurations.

Device setup – provides access to the Device Setup menu. Configurable device parameters common to all HART-compatible devices can be accessed from this menu.

Primary Variable (PV) –the dynamic primary variable and the related engineering unit. When the primary variable contains too many characters to display on the Online menu, access the PV menu to view the primary variable and related engineering units by pressing "1."

Analog Output (AO) – the dynamic output and the related engineering units. The analog output is a signal on the 4-20 mA scale that corresponds to the primary variable. When analog output contains too many characters to display on the Online menu, access the PV AO Menu to view the analog output and related engineering unit by pressing "3."

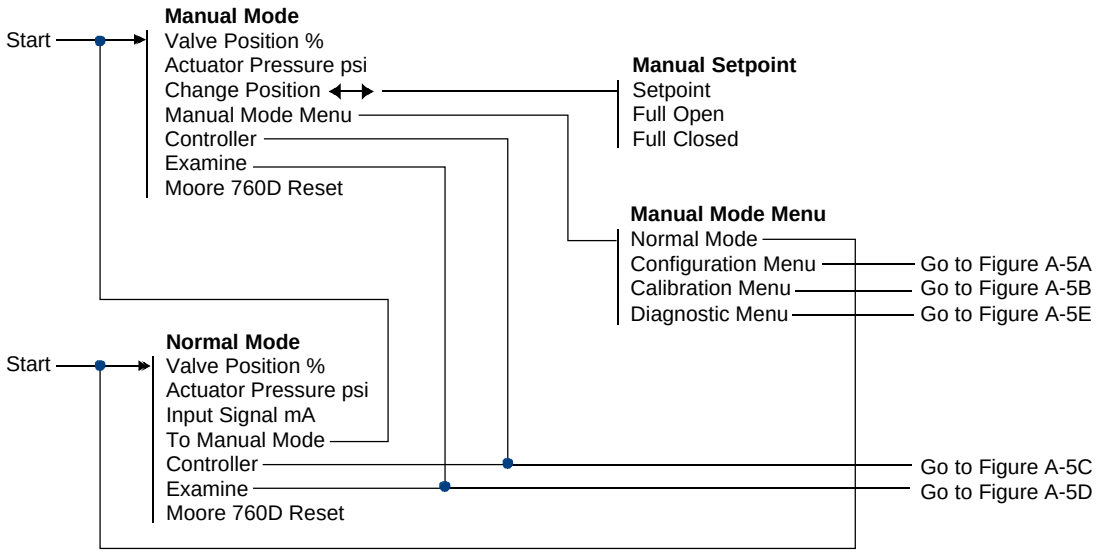


FIGURE A-5 On-Line Menu Selection Tree

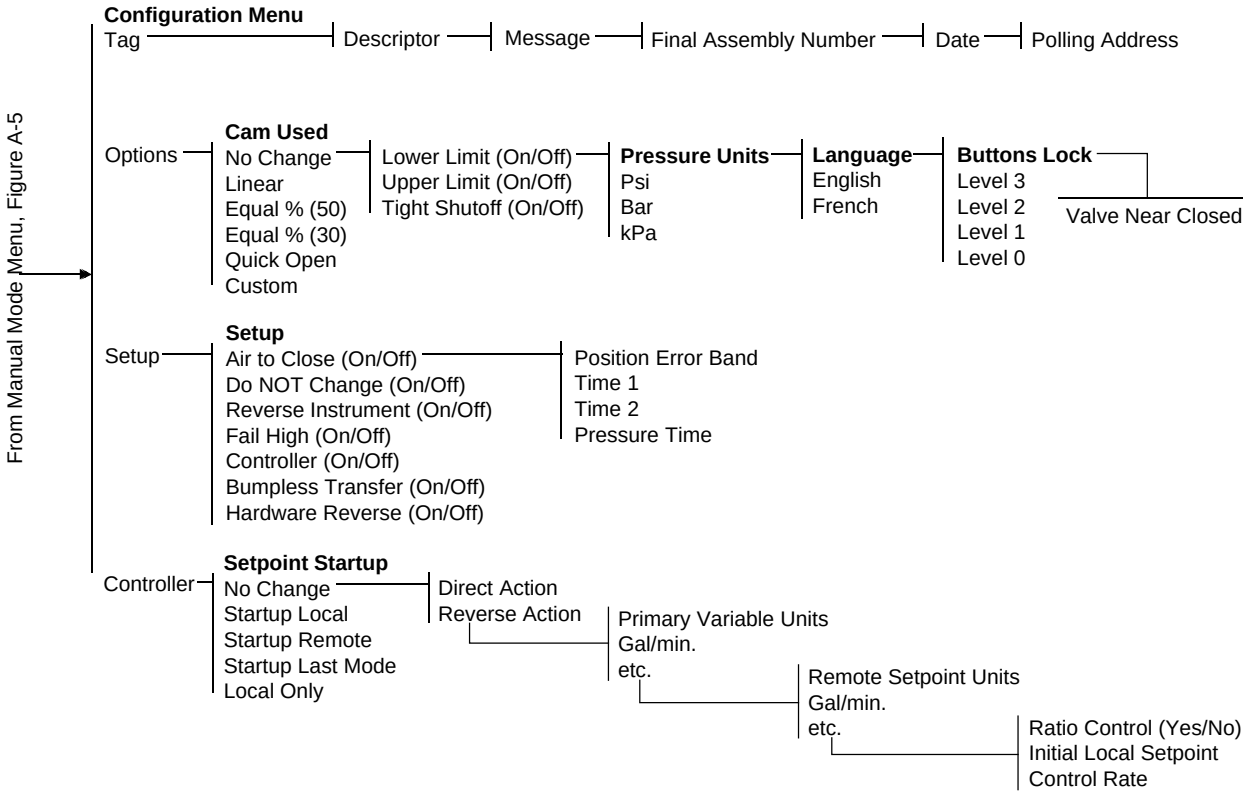


FIGURE A-5A On-Line Configuration Menu Tree

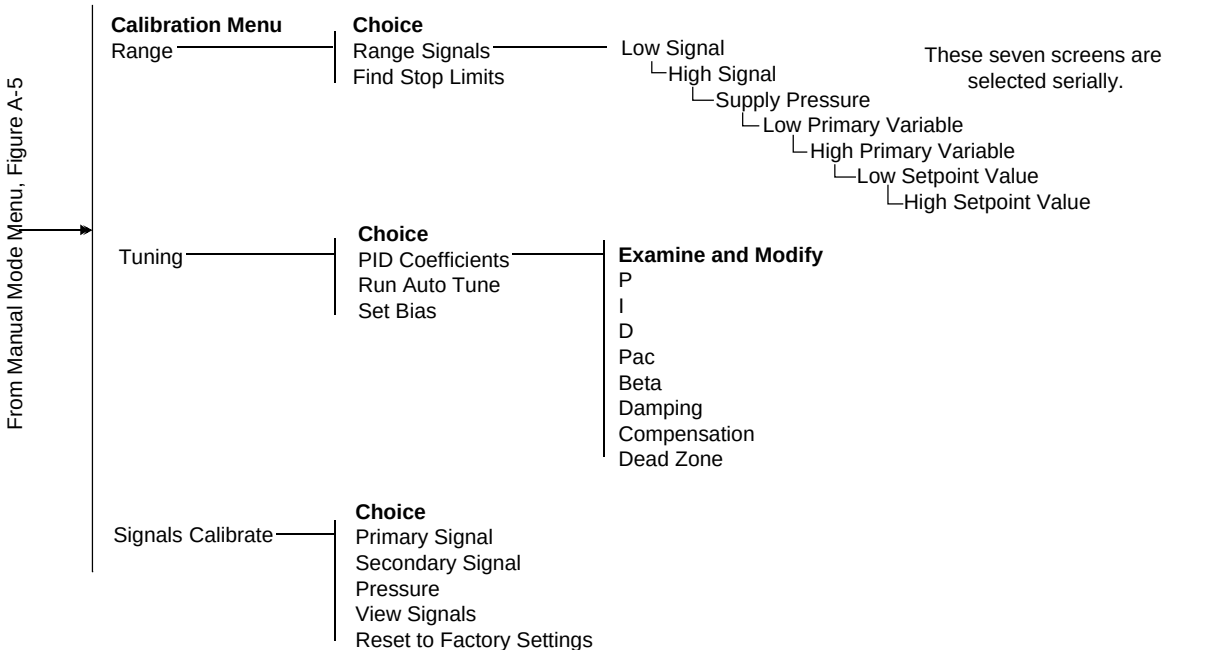


FIGURE A-5B On-Line Calibration Menu Tree

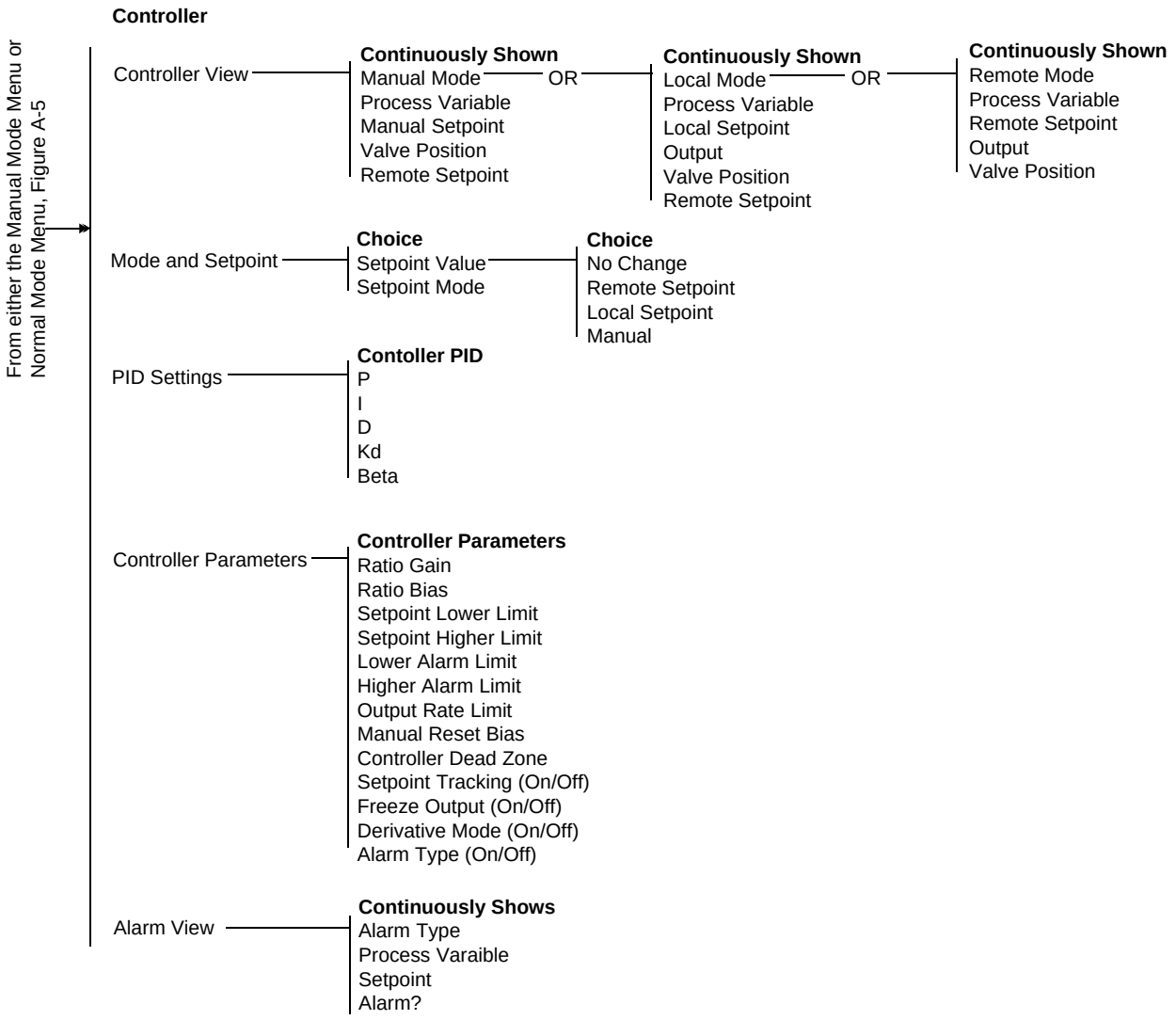


FIGURE A-5C On-Line Controller Menu Tree

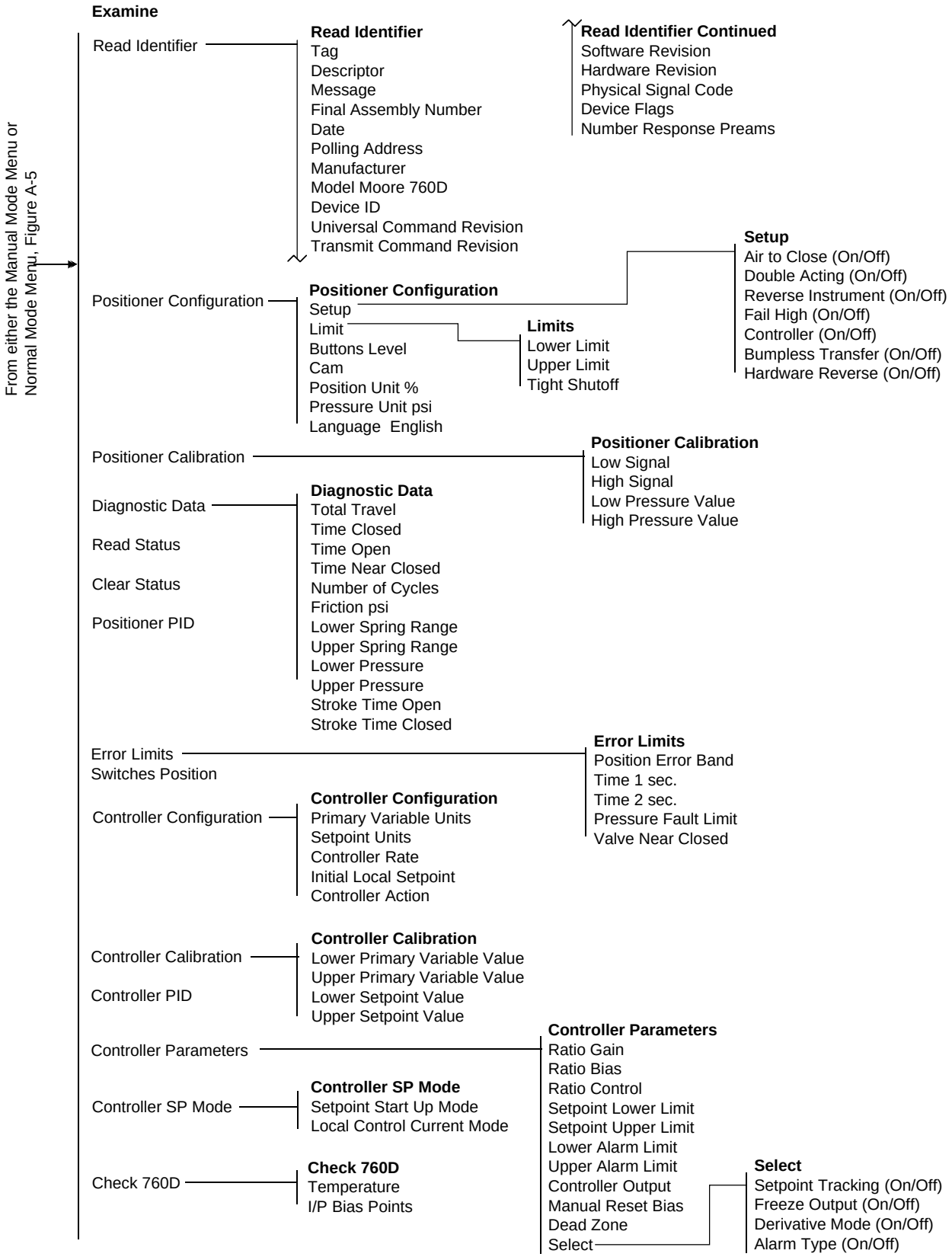


FIGURE A-5D On-Line Examine Menu Tree

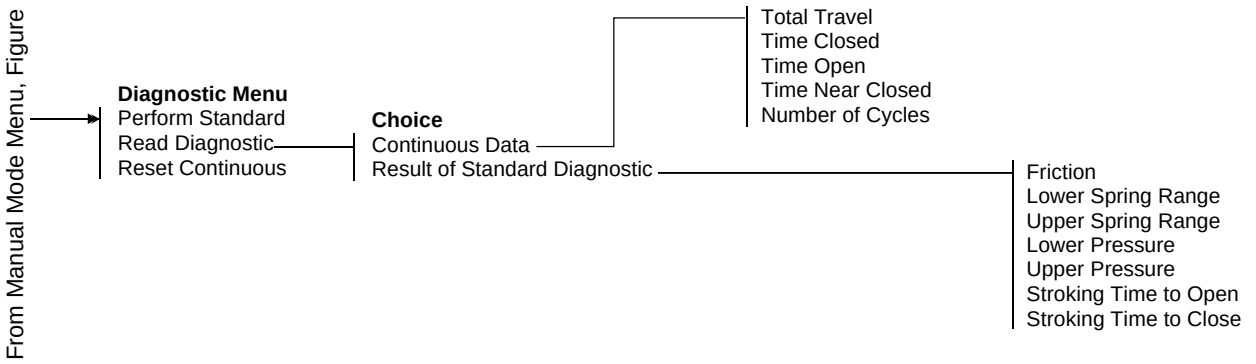


FIGURE A-5E On-Line Diagnostic Menu Tree

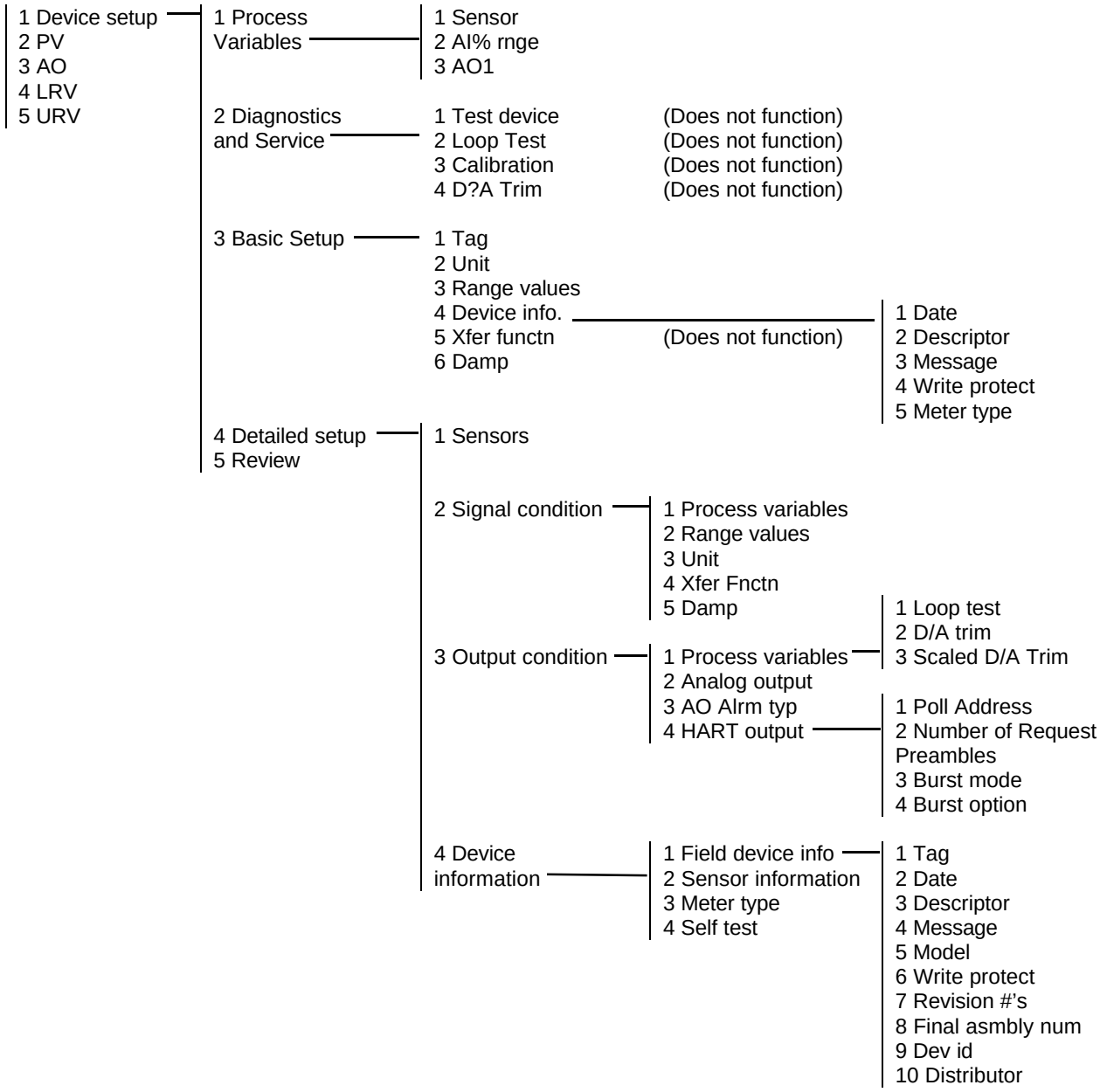


FIGURE A-6 Generic Online Menu Tree

Lower Range Value (LRV) – the current lower range value and the related engineering unit. When the lower range value contains too many characters to display on the Online menu, access the PV LRV Menu to view the lower range value and related engineering unit by pressing "4."

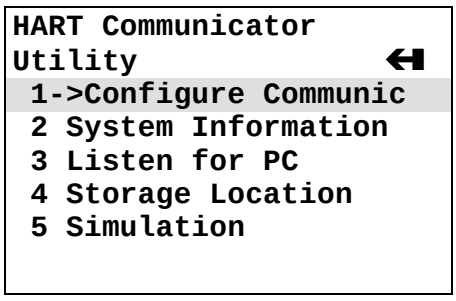
Upper Range Value (URV) – the current upper range value and the related engineering unit. When the lower range value contains too many characters to display on the Online menu, access the PV URV Menu to view the upper range value and related engineering unit by pressing "5."

A.5.3 Frequency Device Menu

From the Main menu, press "3" to access the Frequency Device menu. This menu displays the frequency output and corresponding pressure output for current-to-pressure devices. For a ValvePAC Valve Controller, the display frequency and pressure values are both "none."

A.5.4 Utility Menu

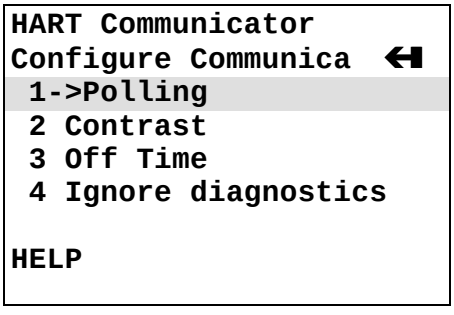
From the Main menu, press "4" to access the Utility menu (at right). This menu provides functions that affect the operation of the Communicator, not the connected devices.



A.5.4.1 Configure Communicator

From the Utility Menu, press "1" to access the Configure Communicator menu (below right). Use this menu to set the polling, adjust the contrast of the LCD, set the Communicator shutoff time, or set how many diagnostics messages to ignore before a warning message is displayed.

All Hart devices have polling addresses that is originally set to "0," and can be reset to any value from 0 to 15. When a HART Communicator is connected to an instrument loop it initially checks for a device with a polling address of 0. If no device is found with this address, the Communicator can poll the loop to find devices with other polling addresses. The Communicator then finds every device in the loop and lists them by tag number. The Communicator then finds every device in the loop and lists them by tag number. Use the **Polling** option to direct the HART Communicator to search for additional connected devices. If Polling is Never Poll, then the Communicator will not check for a connected device with a polling address other than 0. Polling addresses are used for devices used in a Multi-drop application, which will be discussed later.



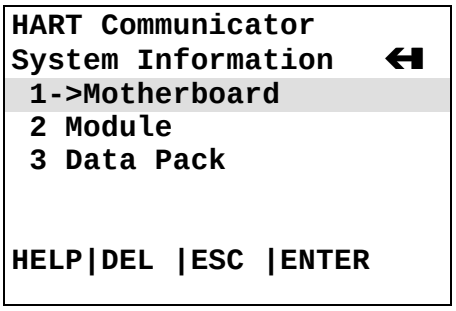
The **Contrast** menu is used to change the LCD contrast. Contrast returns to the default value when the Communicator is turned off.

Off Time is used to set the Communicator to turn off automatically when not in use to conserve battery power.

The Communicator normally displays diagnostic messages from a connected device. The **Ignore Diagnostics** option permits the user to specify the number of messages to ignore so that messages will not be displayed as often, extending the time between displayed messages. The message count defaults to a nominal count of 50 each time the Communicator is turned on. It can be set to a maximum of 500.

A.5.4.2 System Information

From the Utility menu, press "2" to access the System Information menu (at right). This menu can be used to provide information on the motherboard (e.g., firmware revision number), the module hardware and software characteristics, and the Data Pack EEPROM.

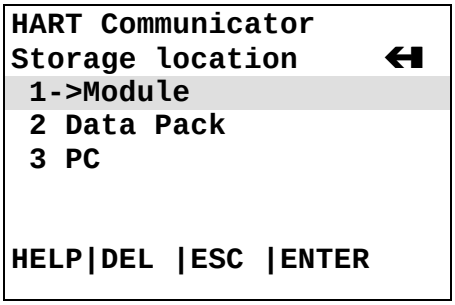


A.5.4.3 Listen for PC

Not implemented.

A.5.4.4 Storage Location

From the Utility menu, the Storage Location menu (at right) provides access to data concerning the Memory Module or the Data Pack. Information available through this menu includes a label for the Memory Module or Data Pack, a feature that displays the total storage used (bytes) and the storage remaining ("free" bytes). PC selection is not implemented.



A.5.4.5 Simulation

Use Simulation mode to simulate an on-line connection to a HART-compatible device without connecting to the device. Simulation mode is a training tool that allows users to become familiar with different devices before configuring them in a critical environment.

First, select a manufacturer from the Manufacturer menu, then select a device from the Model menu, just as is done when on-line. After selecting a software revision, the Online menu for the simulated device is displayed. Functions are the same as those available when on-line.

A.6 USING THE QUICK ACCESS KEY

Pressing the Quick Access Key (Hot Key) while on-line displays the Quick Access Key menu, a user-definable menu that provides immediate access to up to 20 frequently performed tasks. The Quick Access Key menu is accessible when the Communicator is powered and on-line, or when the Communicator is off, by simply pressing the Quick Access Key. For the Quick Access Key to be active, the Communicator must be connected properly to a HART-compatible device.

From the factory, the Quick Access Key menu includes (for the ValvePAC Valve Controller):

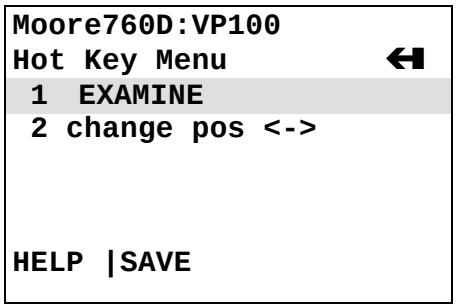
- **Examine** – View such device information as identifiers, configuration, calibration, diagnostic data, and status.
- **Change Position** – Allows an operator to change the position setpoint.

More options can be added to provide rapid access to frequently performed tasks. User-defined options can be deleted later, but these two factory options are permanent.

To use the Quick Access Key:

1. Connect the Communicator to a HART-compatible device.
2. Press the Quick Access Key (upper right-hand key in the action keys group). The Communicator will power-up and display the Quick Access Key menu (at right).

   Before any custom options have been installed, the Quick Access Key menu displays only the two factory-installed options. To add options, see below.
3. Use the UP and DOWN arrows followed by the RIGHT ARROW/SELECT key to choose an option, or press the option's number on the keypad. The menu for the chosen option displays.
4. When finished, press the Quick Access Key to return to the previous menu.

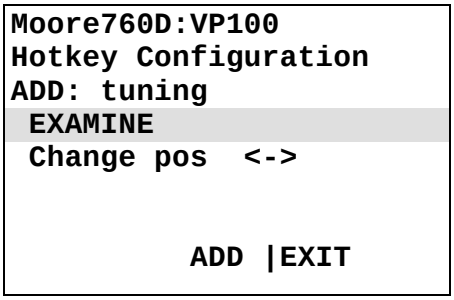


A.6.1 Adding Quick Access Key Options

The Quick Access Key menu contains space for up to 20 on-line options. For example, if device tags and configurations must be changed often, simply add both to the menu. The Communicator automatically saves them so they can be accessed quickly by pressing the Quick Access Key. From one of the menus or submenus reached via the Online menu, use the following steps to add customized options to the Quick Access Key Menu:

1. Using the UP or DOWN arrow keys, move the menu bar to highlight the option to be added to the Quick Access Key menu (e.g., Tuning, under the Calibrate Menu menu).
2. Press any shift key, release it, then press the Quick Access Key. The Hotkey Configuration menu displays (below).

The Hotkey Configuration menu displays the new topic being added to the list of current Quick Access Key options. For example, in the figure at right, tuning is being added.



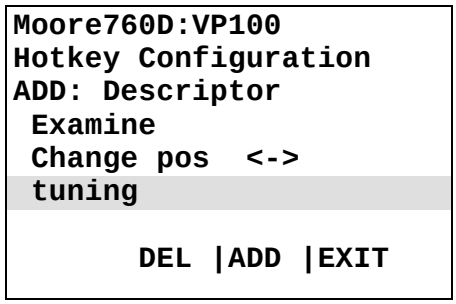
3. Press ADD (F3) to add the option. Pressing EXIT (F4) terminates the procedure and displays the menu that was displayed when "Shift," Quick Access Key was pressed.
4. Next, the question "Mark as read-only variable on Quick Access Key menu?" may appear. Press YES (F1) to mark the variable for this option as read-only. Press NO (F4) to mark the variable as read/write. Marking a parameter for a device as read-only allows users to view, but not change, the parameter using the Quick Access Key Menu. Marking it as read/write permits the value to be changed from the Quick Access Key menu.

   Finally, "Display value of variable on hotkey menu?" may be displayed. Press YES (F1) to display the current variable associated with the option next to the option on the Quick Access Key menu as shown at right for Damping and Tag. Press NO (F2) not to display the variable on the Quick Access Key menu.
5. When finished adding options, press EXIT (F4) to exit the Hotkey Configuration menu and return to the menu of the last option deleted.

A.6.2 Deleting Quick Access Key Options

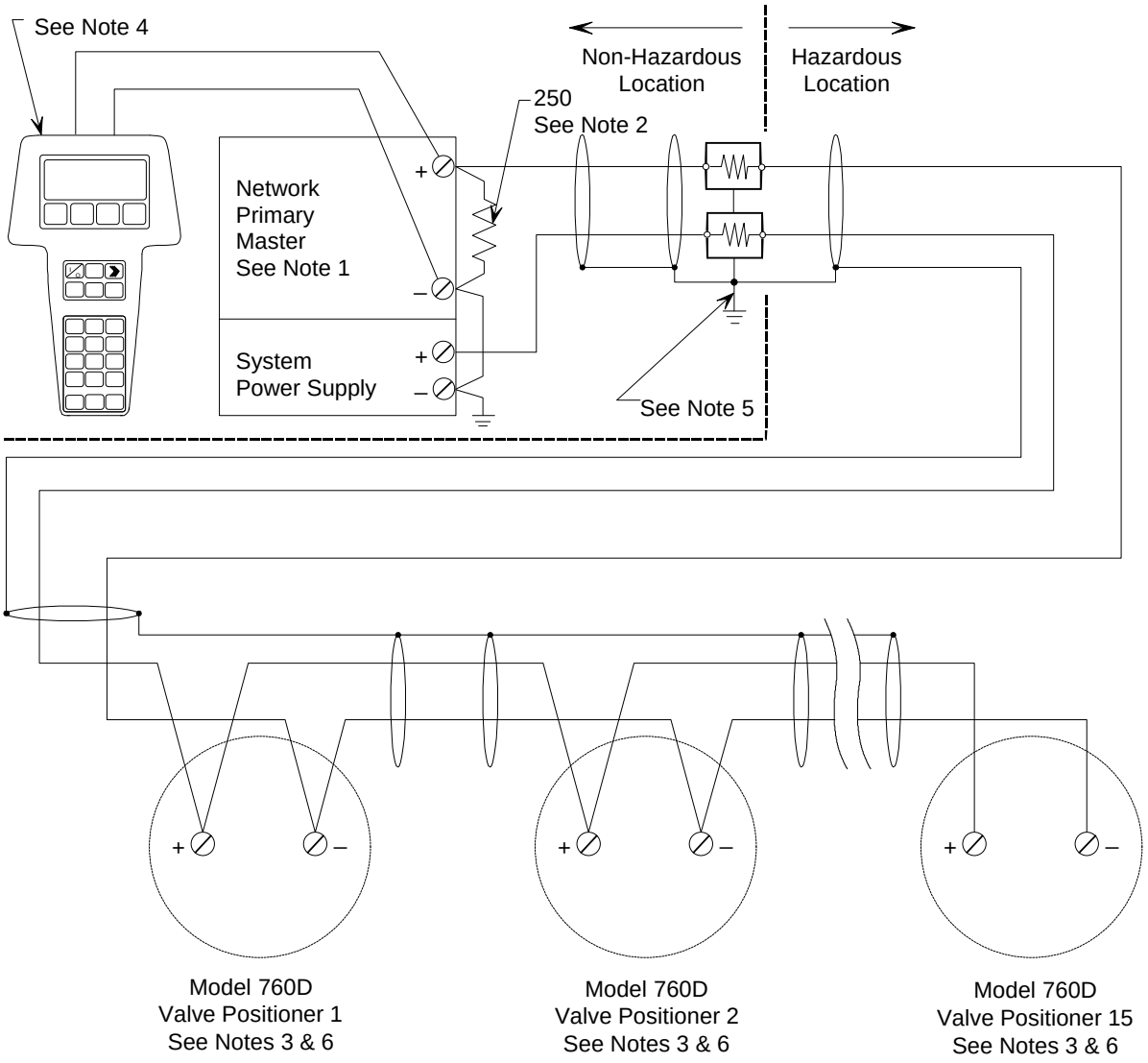
Use the following steps to delete an option from the Quick Access Key menu:

1. From any on-line menu, press any shift key, release it, then press the Quick Access Key.
2. The Hotkey Configuration menu displays (at right).
3. Using the UP or DOWN arrow key, move the menu bar to highlight the option to be deleted and press DEL (F2). Factory-provided options cannot be deleted.
4. When finished deleting options, press EXIT (F4) to exit the Hotkey Configuration menu and return to the menu of the last option deleted.



A.7 MULTI-DROP NETWORK

As many as 15 ValvePAC Valve Controllers may be connected together and powered on a single pair of wires (Figure A-7). Each unit must be set to the Multi-Drop function by positioning the jumper on the terminal board. Each unit must be configured with a unique, Polling Address number from 1 to 15 before being installed in the loop. Each unit must be set to Manual Mode operation, and controlled with HART commands.



Notes:

1. The System Power Supply is shown separate from the host input device. In practice, it may be part of the host input device. The host input device can either be a HART or non-HART signaling device, a Primary Master or Secondary Master.

2. Network resistance equals the sum of the barrier resistances and the current sense resistor. Minimum value 250 Ohms; maximum value 1100 Ohms.

3. A maximum of 15 instruments may be connected. All must be configured for digital mode.

4. Connect the HART Communicator as shown in Figure A-2 for hazardous or non-hazardous locations. The HART Communicator is a non-polar device.

5. Supply and return barriers shown. Interconnect all cable shields and ground only at the barriers.

6. For access to terminals, remove enclosure cover.

AG00239a

FIGURE A-7 Multi-Drop Network

MOORE®
Process Automation Solutions

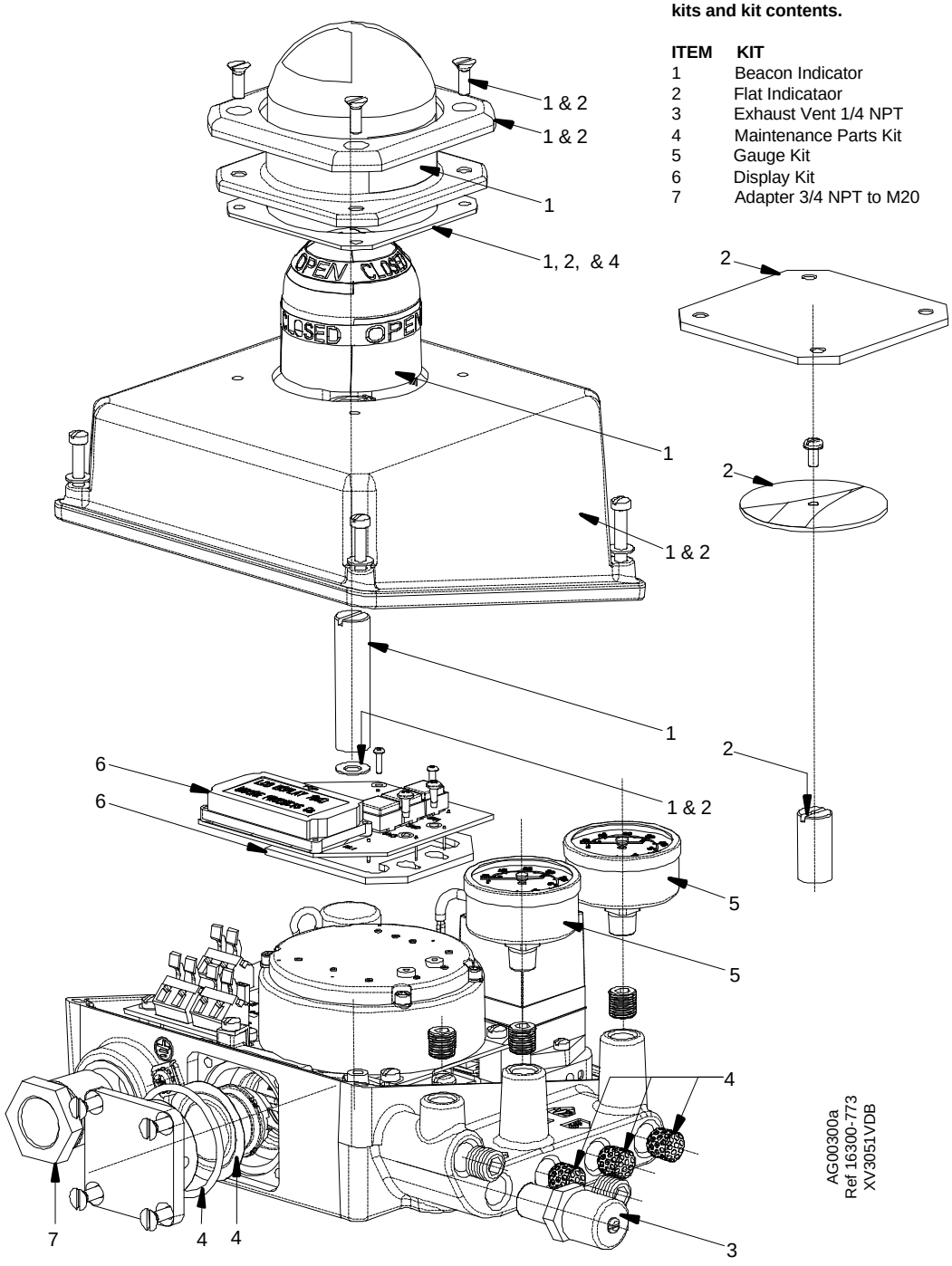
PARTS LIST

PL760D-1
Rev. 1
July 1999

MODEL 760D VALVEPAC

See the next page for a list of kits and kit contents.

ITEM	KIT
1	Beacon Indicator
2	Flat Indicataor
3	Exhaust Vent 1/4 NPT
4	Maintenance Parts Kit
5	Gauge Kit
6	Display Kit
7	Adapter 3/4 NPT to M20



KIT NAME	PART NUMBER	CONTENTS	QUANTITY
1 - Beacon Indicator Kit	16300-488	Beacon Indicator Kit Instructions	1
		Beacon Indicator	1
		Extend-O-Shaft Indicator	1
		Indicator Cover 760	1
		Beacon Lens	1
		Enclosure Cover Gasket	1
		Lens Gasket	1
		Lens Clamping Plate	1
		Retaining Ring, 0.625 Shaft	1
		Label, 760 Beacon Top	1
		Label, 760 Beacon Bottom	1
		8-32 x 0.50 Flat Head Screw	4
		8-32 x 0.938 Fillister Head Screw	4
		#8 Flat Washer	4
		Washer Cup, 0.255 x 0.50	1
2 - Flat Indicator Kit (Lever)	16300-486	Instructions Flat Indicator	1
		Flat Indicator 760	1
		Standoff, 1.00 Long, #6-32F	1
		Indicator Cover 760	1
		Lens, Flat Indicator	1
		Enclosure Cover Gasket	1
		Lens Gasket	1
		Lens Clamping Plate	1
		Label, Electrostatic Hazard	1
		6-32 x 0.313 Pan Head Screw	4
		8-32 x 0.50 Flat Head Screw	4
		8-32 x 0.938 Fillister Head Screw	4
		#8 Flat Washer	4
		Washer, Cup, 0.255 x 0.50	1
2 - Flat Indicator Kit (1/4 Turn)	16300-487	Instructions Flat Indicator	1
		Flat Indicator 760	1
		Standoff, 1.00 Lg, #6-32F	1
		Indicator Cover 760	1
		Lens, Flat Indicator	1
		Enclosure Cover Gasket	1
		Lens Gasket	1
		Lens Clamping Plate	1
		Label, Electrostatic Hazard	1
		6-32 x 0.313 Pan Head Screw	4
		8-32 x 0.50 Flat Head Screw	4
		8-32 x 0.938 Fillister Head Screw	4
		#8 Flat Washer	4
		Washer Cup, 0.255 x 0.50	1
3 - Exhaust Vent, 1/4 NPT	16300-203	-----	1
4 - Maintenance Parts Kit	16300-762	Filter Screen	3
		Lens Gasket	1
		Diaphragm, Neoprene/Nylon	1
		O-Ring, Neoprene (1.487 x 0.103)	1
5 - Gage Kit	16300-763	Gage 1-160 PSI 1/8 NPT	2

6 - Local Display with Push Buttons Kit	16300-820	Display PCB Assembly, 760D LCD Spacer 760D #2 x 0.313 Philips Pan Head Screw #4 x 0.313 Philips Pan Head Screw	1 1 2 2
7 - Adapter, 3/4 NPT to M20 X 1.5F, Brass	2438-7	-----	1

NOTES:
1. Seven kits and their contents are shown in the above lists. The exploded view drawing has callout numbers 1-7 to correlate parts/assemblies to listed kits.
2. Refer to Model 760D User's Manual UM760D-1 for servicing information.

■